Burden of Asthma in Massachusetts

Massachusetts Department of Public Health
Asthma Prevention and Control Program

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Executive Summary

Asthma is a significant public health problem in the United States and in Massachusetts. In 2006 in the United States, over 22.8 million people currently had asthma (1 in 13 Americans), including an estimated 9.3% of children and 7.3% of adults. Nationally, the prevalence of asthma has been increasing since 1980 across all age, sex, and racial groups. The prevalence of asthma in Massachusetts is among the highest reported for states across the nation.

The costs associated with asthma are substantial. The American Lung Association estimates that the cost of asthma in 2007 was $19.7 billion for both direct and indirect costs. Furthermore, asthma resulted in 12.8 million missed school days and nearly 10.1 million missed workdays in the US.

The purpose of this report is to provide asthma prevention advocates and professionals working with individuals affected by asthma with information needed to plan asthma prevention and control activities in Massachusetts. The data in this document highlight the continued need for aggressive action to improve asthma outcomes in the Commonwealth. In response to the data presented in this report, the Massachusetts Department of Public Health, in partnership with the Massachusetts Asthma Advocacy Partnership, has developed recommendations for improving asthma outcomes in Massachusetts. These are outlined in a companion document called *A Strategic Plan for Asthma in Massachusetts, 2009 – 2014*.

Below are key data findings on the burden of asthma in Massachusetts from this report:

The Prevalence of Asthma is High in Massachusetts

- In 2007, approximately 1 in 10 people in Massachusetts – 9.9% of adults and 10.3% children – currently had asthma.
- Adult asthma prevalence is increasing. From 2000 through 2007, the prevalence of lifetime asthma increased 29.4% and current asthma increased 16.5% among Massachusetts adults.
- The prevalence of lifetime and current asthma among adults was higher in Massachusetts than the nation.
- In Massachusetts, prevalence of current asthma was higher among
    - Adult females compared to adult males
    - Male children compared to female children
    - Adults and children in households with lower incomes
    - Adults and children in households with lower educational attainment of the adult
    - Adults who smoke
    - Adults and children who have a disability
- The prevalence of lifetime asthma in Massachusetts was higher among Hispanic (17.3%) than White, non-Hispanic (14.6%) adults, whereas the prevalence of current

asthma among adults was similar across race/ethnicity subgroups from 2005 through 2007.
- Among children in Massachusetts, the prevalence of current asthma was higher among Black, non-Hispanic and Hispanic children than White, non-Hispanic children. However, these differences were not statistically significant.
- Among Massachusetts adults who were ever diagnosed with asthma, 49% were first diagnosed as an adult.

Asthma Seriously Affects the Lives of People in Massachusetts
- In Massachusetts, 75.7% of adults and 65.2% of children with current asthma were classified as having not well controlled or very poorly controlled asthma.
    - Among adults with poorly controlled asthma, 42.7% reported cost was a barrier to care.
- 57.8% of adults with current asthma reported they limited their usual activities a little to a moderate amount. 4.7% limited their usual activities a lot.
- Approximately 21.9% of adults with current asthma were unable to work for at least one day during the past twelve months due to asthma.
- 35.2% of Massachusetts adults with current asthma reported a diagnosis of depression.

Massachusetts is Meeting National Targets for Asthma Self-Management Education
- Massachusetts is demonstrating progress towards meeting Healthy People 2010 (HP2010) targets for asthma. Among adults with current asthma,
    - 97.6% received instruction on how to use a prescribed inhaler properly (HP2010 Target: 98.8%)
    - 79.8% were taught how to respond to an asthma attack or episode (HP2010 Target: 71%)
    - 33.4% received an asthma action plan (HP2010 Target: 38%)

Asthma is Costly
- The total charges for hospitalization due to asthma in Massachusetts increased 77.7% from $50 million in 2000 to $89 million in 2006.
- In 2006, public insurance (including Free Care, Medicare, and Medicaid) was the expected payer for 62.6% of hospitalizations due to asthma.

Many Working Adults Report Their Work Environment Causes or Makes Their Asthma Worse
- Among adults with current asthma, 40.2% reported that their asthma was either caused or made worse by exposures at either their current or previous job.
- Among adults with lifetime asthma who reported that their asthma was caused or made worse by either their current or previous job, only 26.8% (95% C.I. 24.2-29.4) reported discussing the relation of their asthma to work with their health care provider.

Hospital Utilization for Asthma is High but Stable

- In 2005, there were 36,146 emergency department discharges, 9,457 hospitalizations (in 2006), and 2,101 observation stays due to asthma in Massachusetts.
- On average from 2002 through 2005 there were
    - 37,412 episodes of care due to asthma at an emergency department every year, and
    - 102 episodes of care due to asthma at an emergency department every day.
- From 1994 through 1998, the age-adjusted rate of hospitalizations due to asthma decreased 31% from 18.4 to 12.7 per 10,000 residents. From 1999 through 2006, the rate remained relatively stable from 13.5 to 14.7 per 10,000 residents, despite an increase in prevalence.
- The rate of emergency department visits due to asthma also remained stable from 2002 through 2005.

Disparities Exist in Hospitalizations, Emergency Department Visits, and Outpatient Observation Stays

By Age

- Children ages 0-4 years had the highest rates of emergency department visits, outpatient observation stays, and hospitalization due to asthma.
- Adults ages 65 years and older had the 2nd highest rate of hospitalization due to asthma, but had the lowest rates of emergency department visits and outpatient observation stays due to asthma.
- From 2000 through 2006, the rate of hospitalization due to asthma among adults ages 65 years and older increased 49.4% from 17.6 to 26.3 per 10,000 residents.
- In 2006, the average length of stay for a hospitalization due to asthma varied by age group from a low of 2.0 days among children ages 0-4 years to a high of 4.7 days among adults ages 65+ years.

By Gender

- Similar to the pattern in prevalence by gender and age subgroup, the rates of hospitalization due to asthma were higher among males than females in the 0-4 and 5-11 age subgroups. Starting in the 18-24 age subgroups, the rates of hospitalization due to asthma were higher among females than males.

By Race/Ethnicity

- From 2000 through 2006, Black, non-Hispanics and Hispanics consistently had substantially higher age-adjusted rates of hospitalization due to asthma than White, non-Hispanics.

By Geography

- The three-year average rates of hospitalization due to asthma were not evenly distributed among the Community Health Network Area's (CHNA) in the state. The CHNA's with a rate higher than the statewide rate (14.1 per 10,000 residents) were:
    - CHNA 25: Partners for Healthier Communities (Fall River) (29.3 per 10,000)

- CHNA 19: Alliance for Community Health (Boston/Chelsea/Revere/Winthrop) (25.5 per 10,000)
- CHNA 26: Greater New Bedford Community Health Network (22.5 per 10,000)
- CHNA 22: Greater Brockton Community Health Network (19.0 per 10,000)
- CHNA 8: Common Pathways (Worcester) (16.6 per 10,000)
- CHNA 4: The Community Health Connection (Springfield) (16.1 per 10,000)
- CHNA 5: Community Health Network of Southern Worcester County (16.0 per 10,000).

By Season

- The highest frequency of hospitalizations due to asthma was in the fall/winter months and the lowest frequency was in the summer months.

Asthma Mortality is Rare but Disparities Exist

- From 1990 through 2006, there were 1,708 deaths due to asthma among Massachusetts residents, an average of 100 per year. During this time period, the Massachusetts asthma death rate decreased 63.8% from 19.6 to 7.1 per 1,000,000 residents (ρ=-0.922, p<0.0001).

By Age

- The five-year (2002-2006) average age-specific death rate due to asthma was highest among adults ages 65 years and older in Massachusetts (46.9 per 1,000,000 residents).

By Race/Ethnicity

- The five-year (2002-2006) average age-adjusted death rate due to asthma among Black, non-Hispanics was 3.4 times the rate among White, non-Hispanics. Among Hispanics, the rate was 2.7 times the rate among White, non-Hispanics.

By Geography

- The five-year average death rate due to asthma was higher in CHNA 19: Alliance for Community Health (16.8 per 1,000,000 residents) than the overall statewide rate (10.5 per 1,000,0000 residents).

The Massachusetts Department of Public Health, Asthma Prevention and Control Program (APCP), in collaboration with other state agencies and community partners is working to improve the quality of life for all Massachusetts residents with asthma and to reduce disparities in asthma outcomes. The scope of the APCP includes conducting asthma surveillance, supporting and promoting state and regional partnerships, researching and sustaining effective interventions to reduce asthma disparities in Massachusetts, and promoting policies that improve asthma outcomes. The APCP also supports primary prevention of asthma in certain occupational settings and reducing exposure to second-hand tobacco smoke, where possible. Because the optimal public health approach to the prevention and control of asthma is multifaceted, a coordinated approach that involves all stakeholders – individuals, families, communities, employers, employees and unions, health care providers, schools, daycare centers, housing

providers and government organizations – is essential to reduce the burden of asthma in Massachusetts.

Asthma in Massachusetts is a considerable and growing public health problem that significantly affects the lives of many individuals in the Commonwealth. This document highlights the need for aggressive action to improve asthma outcomes and reduce asthma disparities in the Commonwealth. The recommendations in the state's strategic plan for asthma, informed by these findings, provide a blueprint for action to reduce the human and economic costs of asthma in Massachusetts.

Introduction

Asthma in the United States

Asthma is a considerable and growing public health problem in the United States and in Massachusetts. In 2006 in the US, over 22.9 million people currently had asthma (or 1 in 13 Americans), including an estimated 9.3% of children (6.8 million) and 7.3% of adults (16.0 million).[1 19] Asthma is the most common chronic disease among children.[2] Nationally, the prevalence of asthma has been increasing since 1980 across all age, sex, and racial groups.[3 4] The Northeast region has higher prevalence of asthma than other regions of the country for both children and adults.[3 4] Among the six New England states, the prevalence of asthma in Massachusetts remains one of the highest.[5]

The asthma burden, as measured by health care use and mortality, remains high even though medications and our understanding of how to manage asthma have significantly improved over the last 20 years. In 2004 alone, asthma accounted for approximately 14.7 million outpatient visits to physician offices and hospital outpatient departments, 1.8 million emergency department visits and 500,000 hospitalizations in the US.[1] There are more than 4,000 deaths due to asthma each year, many of which are avoidable with proper treatment and care.[1]

The costs, both direct and indirect, associated with asthma are substantial. The American Lung Association estimates that asthma burdens our nation with an annual economic cost of $14.7 billion in direct health care costs and another $5 billion in indirect costs (lost productivity) for a total of $19.7 billion (in 2007 dollars).[6] Furthermore, in 2003, the Centers for Disease Control and Prevention (CDC) estimated that asthma resulted in 12.8 million missed school days among children ages 5-17 years and nearly 10.1 million missed workdays among adults currently employed.[1]

Asthma in Massachusetts: The Current Report

This report is an update to the previous surveillance report published in 2006 and provides the most currently available data on the burden of asthma among Massachusetts residents. It examines this burden over time, by demographic and socioeconomic characteristics, and by geographic region. The purpose of this report is to provide asthma prevention advocates and professionals working with individuals affected by asthma with information needed to plan asthma prevention and control activities in Massachusetts. It establishes a baseline for asthma prevalence, hospital use, management and mortality that can be used to monitor the progress of these efforts over time. Only by understanding the scope of the problem can effective strategies be implemented to reduce the human and economic burden of asthma in the Commonwealth.

What is Asthma?

Asthma is a chronic inflammatory disease of the airways. Airways become constricted with swelling and excessive mucous production, making it difficult to breathe. Symptoms of asthma are wheezing, coughing, and chest tightness. Sometimes the

symptoms become so severe they result in an asthma attack that requires immediate medical treatment. Asthma affects individuals differently resulting in differing severity, presentation of symptoms and responsiveness to treatment. When not treated, asthma can cause disability and even death.

Causes and Risk Factors of Asthma

The development of asthma relies on a complex interaction between genetics and environmental exposures.[7] The development of asthma has been linked to exposure to environmental tobacco smoke, stress, cockroaches, air pollution and some occupational exposures, such as isocyanates, latex, formaldehyde, and persulfates.[8] People can develop asthma at different stages of their lives and many subsequently cease to have symptoms.[9] A number of studies suggest certain risk factors are associated with the prevalence and severity of the disease. These include some ethnicities, including US born Blacks and Puerto Ricans, as well as certain conditions, including poverty and associated poor housing.[10]

Diagnosis and Management of Asthma

The ultimate goal of asthma management is to have well-controlled asthma so that children and adults with asthma can live normal, active lives. Regular monitoring, treatment and environmental remediation are required to adequately control asthma.

Diagnosing asthma involves a thorough medical history, physical examination and sometimes lung function tests. In 2007, the National Institutes of Health released updated guidance for clinicians on the diagnosis and management of asthma called the 2007 National Asthma Education and Prevention Program Expert Panel Report 3 (EPR3).[11] The EPR3 recognized the difference between an initial assessment of asthma severity at the time of diagnosis and the continual monitoring of asthma control with therapy adjustment based on responsiveness to treatment.

While there is a significant amount of understanding around the diagnosis of asthma, public health challenges associated with the diagnosis of asthma remain. Diagnosis of asthma may be confounded by an alternative diagnosis of another pulmonary condition such as Chronic Obstructive Pulmonary Disease (COPD) particularly in midlife, when symptoms from COPD are most likely to begin.[12] Also, some studies have found that asthma, particularly among children, may be under diagnosed due to many reasons such as inadequate access to a health care provider.[13] These individuals can still suffer the same health consequences as those with a diagnosis of asthma, including missed school, sleep disturbances, emergency room visits, and hospitalizations.

Asthma cannot be cured, but it can be controlled through careful disease management and avoidance of asthma triggers. Emergency department visits, hospitalizations, and deaths due to asthma are preventable with appropriate treatment. Good asthma management requires a strong partnership between the patient with asthma (or parent if the patient is a child) and the clinician to establish joint goals of asthma therapy and environmental remediation. Regular patient self-assessment/monitoring of asthma and communication with the clinician is important for asthma control so asthma medications can be adjusted appropriately as symptoms improve or worsen. An asthma action plan is an important self-management tool that addresses both daily management and recognition and intervention for worsening asthma. Appropriate care of asthma often

requires the use of long-term controller medications to prevent flare-ups and quick-relief rescue medications to control immediate symptoms and prevent exercise-induced asthma symptoms. Environmental changes in the home, school, work or other settings are important methods to control asthma. A number of certain exposures have been associated with making asthma symptoms worse such as cats, cockroaches, damp indoor environments, mold, house dust mites, environmental tobacco smoke, pollen, air pollution, wood smoke, household chemicals, respiratory infections, cold weather and some occupational exposures.[14] [15] EPR3 recommends that people with asthma who are sensitized reduce exposure to allergens. Recent studies have found that an approach to allergen avoidance that is multifaceted and comprehensive is more effective than those that seek to reduce single exposures.

Public Health Strategies in Massachusetts

The control and prevention of asthma requires an understanding of the causes of the disease, accurate and timely diagnosis, effective use of medications, appropriate communication with a clinician, modification of environmental exposures, and changes in personal behaviors that may exacerbate the disease. Prevention of asthma not only includes preventing asthma symptoms through modifying environmental exposures but also preventing asthma onset in a few circumstances. For example, research has found that reducing or eliminating exposure to certain occupational environmental factors can prevent the development of asthma.[16] A multifaceted and coordinated approach that involves all stakeholders – individuals, families, communities, employers, employees and unions, health care providers, schools, daycare centers, housing providers and government organizations – is essential to reduce the burden of asthma in Massachusetts.

The Massachusetts Department of Public Health (MDPH), Asthma Prevention and Control Program (APCP), in collaboration with other state agencies and community partners is working to improve the quality of life for all Massachusetts residents with asthma and to reduce disparities in asthma outcomes. Funded by the Center for Disease Control and Prevention, the scope of the APCP activities includes conducting asthma surveillance, supporting and promoting state and regional partnerships, researching and sustaining effective interventions to reduce asthma disparities in Massachusetts, and promoting policies that improve asthma outcomes. The APCP also supports primary prevention of asthma in certain occupational settings and reducing exposure to second-hand tobacco smoke, where possible. Several strategies undertaken by the APCP to meet the program's mission include:

- Provide Asthma Action Plans for children and adults in seven languages.
- Fund pilot projects in priority regions most affected by hospitalizations due to asthma in Massachusetts (i.e. Boston, Brockton, Springfield, New Bedford, and Fall River) through the Asthma Disparities Initiative. The interventions are designed to improve clinical care and to develop and coordinate regional asthma coalitions.
- Collaborate with other health promotion and disease prevention programs to develop and sustain an infrastructure that supports programmatic integration to help Massachusetts residents manage their chronic diseases.
- Support the Massachusetts Asthma Advocacy Partnership (MAAP), a statewide coalition made up of over 80 member organizations. MAAP is committed to reducing

asthma health disparities in Massachusetts by coordinating statewide advocacy efforts. MAAP links to local efforts across the state by bringing together community organizations and other partners to achieve sustainable statewide changes in the environment, education, and the quality of health care.

This document highlights the continued need for aggressive action to improve asthma outcomes and reduce asthma disparities in the Commonwealth. The recommendations for improving asthma outcomes in Massachusetts, informed by the findings presented in the burden document, were developed in partnership with MAAP and are outlined in a companion document called *A Strategic Plan for Asthma in Massachusetts, 2009 – 2014*.[17] The key components of this plan include:

- Enhancing asthma surveillance
- Improving asthma diagnosis and treatment by health care professionals
- Dedicating limited resources to the regions of the state most affected by asthma
- Improving asthma education and self-management
- Reducing environmental exposures in the home, school and work environments
- Developing a roadmap for exploration of the primary prevention of asthma
- Evaluating the efforts of this plan

Overview of This Report

This report draws on multiple data sources to describe the burden of asthma in Massachusetts. The years for which data are available and used in this report vary by data source.

This report is organized into six sections:

1. Prevalence of asthma among adults and children
2. Factors associated with asthma management
3. Work-related asthma
4. Hospital treatment for asthma
5. Asthma mortality
6. Healthy People 2010 objectives

The methods used for reporting the burden of asthma follow methods similar to those used in the Morbidity and Mortality Weekly Report, *National Surveillance for Asthma – United States, 1980-2004*.[3] Figures presented in this report are accompanied by tables that include the data on which the figures are based. In the text describing the findings, the terms “higher”, “lower”, “more likely”, “less likely”, “increased”, and “decreased” are used only when findings cited were found to be statistically significant at the 95% probability level, unless otherwise noted. To determine if Massachusetts has experienced an overall trend in asthma prevalence, emergency department discharges, observation stays, hospitalizations or deaths due to asthma, the Spearman Correlation Coefficient and its accompanying statistical Rank Correlation Test were utilized. Further methodological details used for analyses and statistical testing of the data are described in Appendix A. Additional supplemental data are provided in Appendix B.

Sources of Asthma Data	Data Owner
❖ Massachusetts Behavioral Risk Factor Surveillance System (BRFSS), 2000-2007	Health Survey Program, MDPH
❖ Massachusetts BRFSS Adult and Child Call Back Surveys, 2006-2007	Health Survey Program, MDPH
❖ Pediatric Asthma Surveillance, 2002/2003 – 2006/2007 School Years	Bureau of Environmental Health, MDPH
❖ Youth Health Survey, 2006/2007 School Year	Massachusetts Department of Elementary and Secondary Education and MDPH
❖ Sentinel Event Notification System for Occupational Risks, 1993-2006	Occupational Health Surveillance Program, MDPH
❖ Massachusetts Inpatient Hospitalization Discharge Database, 1998-2006	Massachusetts Division of Health Care Finance and Policy
❖ Massachusetts Outpatient Observation Stay Database, 1998-2005	Massachusetts Division of Health Care Finance and Policy
❖ Massachusetts Emergency Department Discharge Database, 2002-2005	Massachusetts Division of Health Care Finance and Policy
❖ Death Certificate data, 1990-2006	Registry of Vital Records, MDPH
❖ Essential School Health Services program data, 2006/2007 School Year	Essential School Health Program, MDPH
❖ MassHealth Health Plan and Employer Data and Information Set (HEDIS), 2006	MassHealth

Section 1. Prevalence of Asthma among Adults and Children

Asthma prevalence is the proportion of individuals in a population who have asthma at a point in time or during a given time period. Currently, there are no measures of asthma incidence, or the rate at which people develop asthma over a period of time.

This section presents data on the prevalence of asthma among adults and children in Massachusetts. Time trends are presented if there were significant changes over time using all years of data available. Otherwise, cross-sectional analyses of demographic characteristics are presented using the most recent years of data available for public health planning purposes. In most instances, three years of data are aggregated to derive more stable estimates. Findings are compared to national estimates where possible.

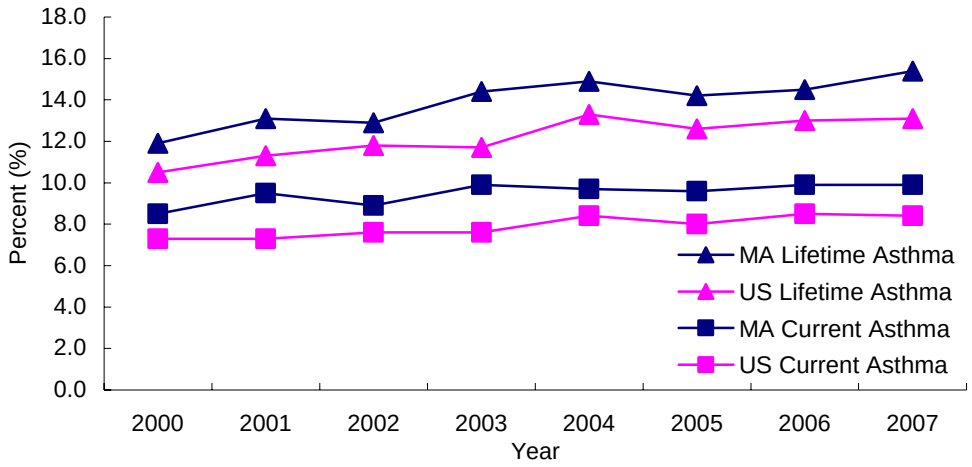
Like most states, Massachusetts prevalence estimates of lifetime and current asthma among adults and children are based on self-reported data collected through the Massachusetts Behavioral Risk Factor Surveillance System (BRFSS). For children under 18 years of age, the information is collected from an adult family member, usually a parent, who is knowledgeable about the child's health. Lifetime asthma status was established from the response given to, "Have you ever been told by a doctor, nurse or health professional that you had asthma?" Current asthma status was established from a positive response to the lifetime asthma question and the response given to, "Do you still have asthma?"

In addition, Massachusetts has two other data sources that are used to estimate the prevalence of lifetime asthma among children. The data sources utilized in this section include the Pediatric Asthma Surveillance (PAS) program, and the Massachusetts Youth Health Survey (YHS). Data from the PAS and the YHS are presented at the end of this section. In interpreting data from the BRFSS, PAS and YHS on the prevalence of childhood asthma, readers should be aware that the definition of "lifetime asthma" and methods of data collection vary among these three data sources.

Additional details about the methodology, survey questions, and data considerations for each data source are provided in Appendix A.

Figure 1.1: Trend in Prevalence of Lifetime and Current Asthma among Adults, 2000-2007

Massachusetts and United States Respondents Ages 18+ Years



	Lifetime Asthma				
	Massachusetts				US
Year	Sample Size [1]	% [2]	95% CI [3]	Estimated Prevalence Number [4]	% [2]
2000	8,139	11.9	11.0 - 12.8	578,600	10.6
2001	8,614	13.1	12.2 - 14.0	642,200	11.2
2002	7,417	12.9	11.9 -13.9	635,900	11.8
2003	7,569	14.4	13.4 -15.4	712,300	11.7
2004	8,182	14.9	13.9 - 15.9	738,500	13.3
2005	8,889	14.2	13.2 - 15.2	705,300	12.6
2006	12,692	14.5	13.5 - 15.5	723,300	13.0
2007	21,449	15.4	14.6 - 16.2	772,600	13.1

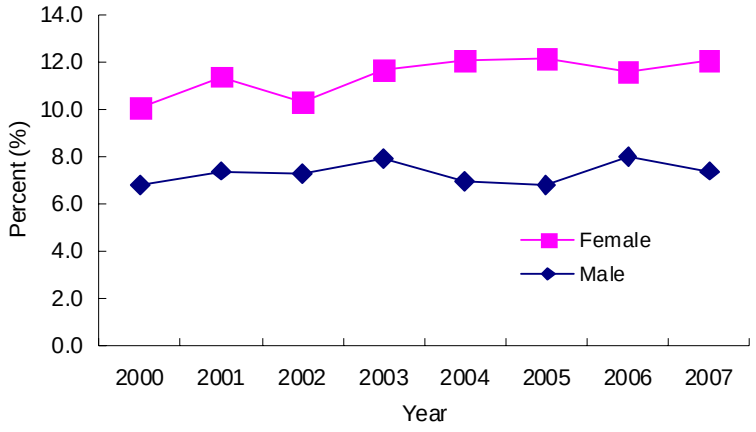
	Current Asthma				
	Massachusetts				US
Year	Sample Size [1]	% [2]	95% CI [3]	Estimated Prevalence Number [4]	% [2]
2000	8,122	8.5	7.8-9.2	413,300	7.3
2001	8,589	9.5	8.7-10.3	465,800	7.3
2002	7,398	8.9	8.1- 9.7	438,700	7.6
2003	7,548	9.9	9.0-10.8	489,700	7.6
2004	8,148	9.7	8.9-10.5	480,700	8.3
2005	8,851	9.6	8.7-10.5	476,800	8.0
2006	12,643	9.9	9.1-10.7	493,800	8.4
2007	21,355	9.9	9.3-10.5	496,700	8.3

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval (for MA).
[4] Prevalence numbers are population estimates.
Data Sources: MA Data: 2000-2007 MA Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health; US Data: 2000-2007 US Behavioral Risk Factor Surveillance System, Centers for Disease Control and Prevention. States includes District of Columbia, Guam, Puerto Rico, and the US Virgin Islands in applicable years.

- From 2000 through 2007, the prevalence of lifetime asthma increased 29.4% (ρ=0.857, p=0.007) and current asthma increased 16.5% (ρ=0.801, p=0.016) among Massachusetts adults.
- Nationally, during this same time frame, the prevalence of lifetime asthma increased 23.6% (ρ=0.833, p=0.010) and current asthma increased 13.7% (ρ=0.909, p=0.002) among adults in the US. [18]
- Of those Massachusetts adults with lifetime asthma, approximately 65% were currently affected by asthma.
- Based on the 2007 estimates, approximately 772,600 adults had lifetime asthma and approximately 496,700 adults in Massachusetts had a current diagnosis of asthma.
- The prevalence of lifetime and current asthma among adults was higher in Massachusetts than in the US for each year examined from 2000 through 2007.

Figure 1.2: Trend in Prevalence of Current Asthma among Adults by Gender, 2000-2007

Massachusetts Respondents Ages 18+ Years

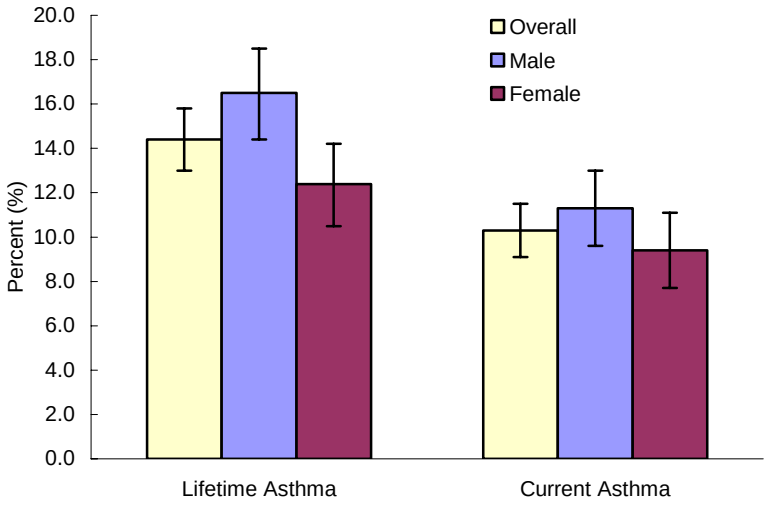


	Male			Female		
Year	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
2000	3,212	6.8	5.8-7.8	4,910	10.1	9.1-11.1
2001	3,543	7.4	6.3-8.5	5,046	11.4	10.3-12.5
2002	2,980	7.3	6.1-8.5	4,418	10.3	9.1-11.5
2003	3,015	7.9	6.7-9.1	4,533	11.7	10.5-12.9
2004	3,201	7.0	5.9-8.1	4,947	12.1	10.9-13.3
2005	3,397	6.8	5.6-8.0	5,454	12.2	10.9-13.5
2006	4,728	8.0	6.7-9.3	7,915	11.6	10.5-12.7
2007	7,558	7.4	6.4-8.4	13,797	12.1	11.3-12.9

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2000-2007 MA Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

- From 2000 through 2007, the prevalence of current asthma was higher among female than male adults in Massachusetts. This trend is consistent with national estimates.[3]
- From 2000 through 2007, the prevalence of current asthma increased 19.8% among females (ρ=0.755, p=0.031), but did not significantly change among males (ρ=0.349, p=0.396). During the same time period, the prevalence of lifetime asthma increased for both females (ρ=0.8095, p=0.015) and males (ρ=0.7904, p=0.020) (see data available in Appendix B).
- In 2007, the prevalence of current asthma among adult males was 7.4% and among females was 12.1%. Based on these prevalence measures, an estimated 173,700 adult males and 310,500 adult females were affected by asthma.

Figure 1.3: Three-year Average Annual Prevalence in Lifetime and Current Asthma among Children by Gender, 2005-2007
Massachusetts Respondents Ages 0-17 Years



	Massachusetts					
	Lifetime Asthma			Current Asthma		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Overall	5045	14.4	13.0-15.8	5026	10.3	9.1-11.5
Gender						
Male	2554	16.5	14.4-18.5	2544	11.3	9.6-13.0
Female	2431	12.4	10.5-14.2	2423	9.4	7.7-11.1

[1] Sample size is the number of respondents who responded the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health.

Lifetime

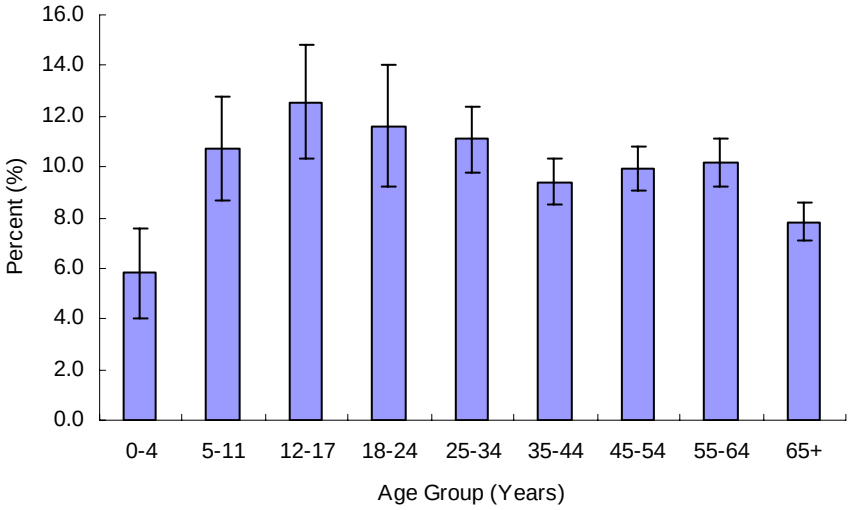
- From 2005 through 2007, the three-year average annual prevalence of lifetime asthma was 14.4% among Massachusetts children.
- The prevalence of lifetime asthma was higher among male (16.5%) than female (12.4%) children.
- This pattern by gender is similar to national trends where the prevalence of lifetime asthma was higher among male children (15.8%) than female children (11.2%).[19]

Current

- During this same time period, the three-year average annual prevalence of current asthma was 10.3% among Massachusetts children.
- The difference in the prevalence of current asthma among Massachusetts children by gender is not statistically significant.
- In contrast to this finding in Massachusetts, previously published reports found that the national prevalence of current asthma was higher among male than female children.[19] [20] [21] In 2006, the US age-adjusted prevalence of current asthma among male children was 11.1% and among female children was 7.6%.[19]

- The pattern among Massachusetts children by gender is in contrast to the prevalence of current asthma among Massachusetts adults, where adult males (7.4%) were less likely to report having current asthma than adult females (12.1%) (see data in Figure 1.2).
- For more data on the prevalence of asthma among Massachusetts children by gender, see data in Figure 1.5, 1.11 and 1.13.

Figure 1.4: Three-year Average Annual Prevalence of Current Asthma by Age Group, 2005-2007
Massachusetts Respondents

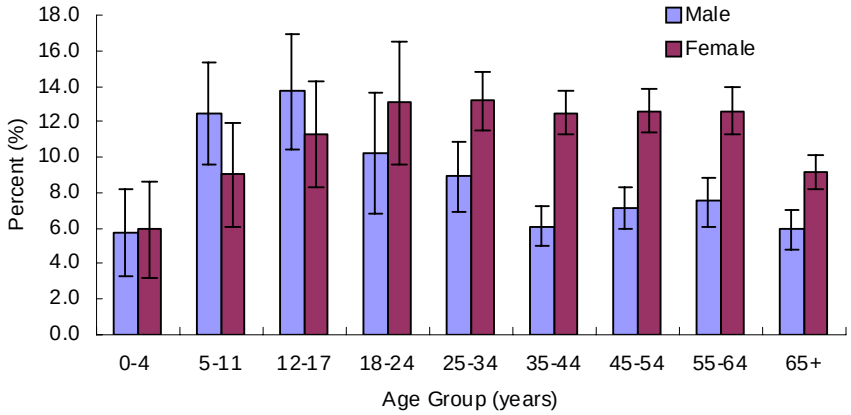


Age Group	Sample Size[1]	%[2]	95% CI[3]
0-17	5,026	10.3	9.1-11.5
18+	42,849	9.8	9.3-10.2
0-4	1,567	5.8	4.0-7.6
5-11	1,732	10.7	8.7-12.8
12-17	1,697	12.5	10.3-14.8
18-24	1,647	11.6	9.2-14.0
25-34	4,765	11.1	9.8-12.4
35-44	7,818	9.4	8.5-10.3
45-54	8,558	9.9	9.1-10.8
55-64	7,981	10.2	9.2-11.1
65+	11,325	7.8	7.1-8.6

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Sources: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health.

- In Massachusetts, current asthma prevalence varied by age group.
- From 2005 through 2007, the three-year average annual prevalence of current asthma was highest among those ages 12-17 years (12.5%) and lowest among those ages 0-4 years (5.8%).
- From 2000 through 2007, the annual prevalence of current asthma increased 37% (ρ=0.755, p=0.031) among those ages 25-34 years and 44% (ρ=0.731, p=0.04) among those ages 65+ years (data available in Appendix B).

Figure 1.5: Three-year Average Annual Prevalence of Current Asthma by Age Group and Gender, 2005-2007
Massachusetts Respondents

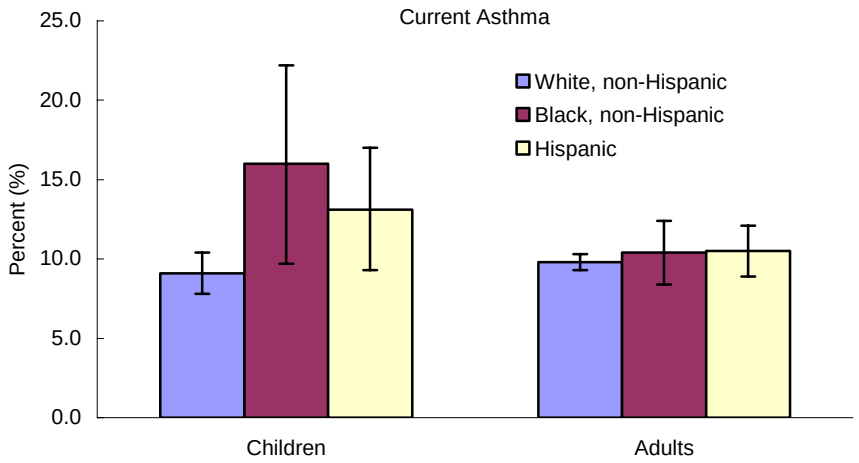


	Male			Female		
Age Group	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
0-4	545	5.7	3.3-8.2	526	5.9	3.2-8.6
5-11	890	12.5	9.6-15.4	839	9.0	6.1-11.9
12-17	852	13.7	10.4-17.0	842	11.3	8.3-14.3
18-24	688	10.2	6.8-13.6	959	13.1	9.6-16.5
25-34	1,620	8.9	6.9-10.9	3,145	13.2	11.5-14.8
35-44	2,924	6.1	5.0-7.2	4,894	12.5	11.3-13.8
45-54	3,369	7.1	6.0-8.3	5,189	12.6	11.4-13.9
55-64	3,017	7.5	6.1-8.8	4,964	12.6	11.3-14.0
65+	3,872	5.9	4.8-7.0	7,453	9.1	8.2-10.1

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

- Overall, when broken into smaller age subgroups, the pattern of current asthma prevalence by gender among Massachusetts children and adults persists. However, the difference by gender is not statistically significant in all age subgroups.
- Starting in the 25-34 year age subgroup, the three-year average annual prevalence of current asthma was higher among females than males.
- Experts speculate that a hormonal change may explain the differences in asthma prevalence by age group and gender.[20]

Figure 1.6: Three-year Average Annual Prevalence of Current Asthma among Children and Adults by Race/Ethnicity, 2005-2007
Massachusetts Respondents



	Current Asthma					
	Children			Adults		
Race/Ethnicity	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
White, non-Hispanic	3,599	9.1	7.8-10.4	35,184	9.8	9.3-10.3
Black, non-Hispanic	292	16.0	9.7-22.2	1,995	10.4	8.4-12.4
Hispanic	791	13.1	9.3-17.0	3,700	10.5	8.9-12.1

	Lifetime Asthma					
	Children			Adults		
Race/Ethnicity	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
White, non-Hispanic	3,614	13.4	11.9-14.9	35,334	14.6	14.0-15.2
Black, non-Hispanic	293	19.7	13.1-26.4	2,004	15.5	13.0-17.9
Hispanic	792	17.0	12.9-21.2	3,709	17.3	15.3-19.5

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

Adults

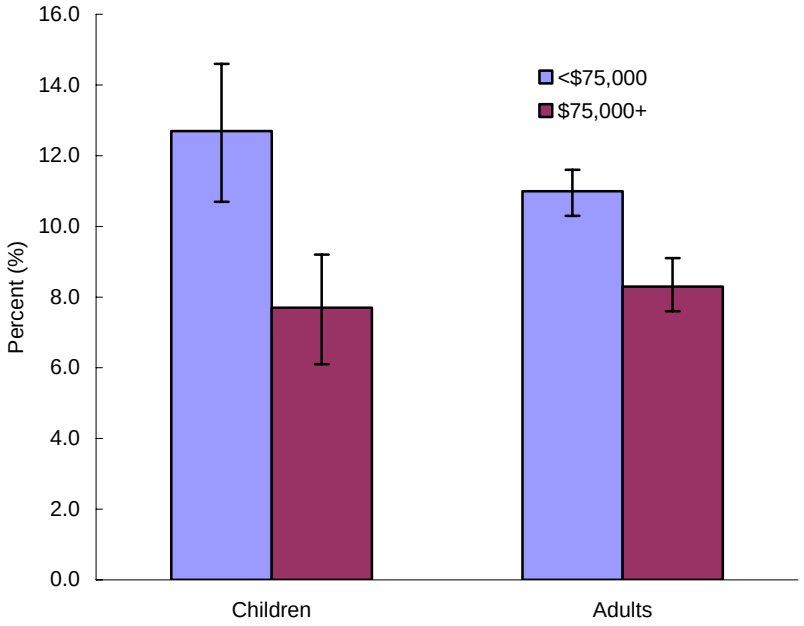
- From 2005 through 2007, the three-year average annual prevalence of current asthma among adults in Massachusetts was similar across race/ethnicity subgroups.
- Nationally, in 2006, the prevalence of current asthma was lower among Hispanic (5.1%) than non-Hispanic (7.6%) adults.[22] The reasons for the differences in prevalence by ethnicity between Massachusetts and the US are unclear, but may be related to regional differences in Hispanic ancestry.
    - Among Hispanics in Massachusetts, there are 6 times as many Puerto Ricans (44%) as there are Mexicans (7%). In contrast, among Hispanics in the US, there are approximately 7 times as many Mexicans (64%) as there are Puerto Ricans (9%) (data available in Appendix B).[23]

- During this time period, the three-year average annual prevalence of lifetime asthma was higher among Hispanic (17.3%) than White, non-Hispanic (14.6%) adults in Massachusetts.

Children

- From 2005 through 2007, the three-year average annual prevalence of current asthma was higher among Black, non-Hispanic and Hispanic children than White, non-Hispanic children. However, these differences were not statistically significant.
- Nationally, in 2006, the prevalence of current asthma was highest among Black, non-Hispanic (12.8%, 95% CI: 11.0-14.6), followed by Hispanic (9.2%, 95% CI: 7.7-10.7) and White, non-Hispanic (8.7%, 95% CI: 7.6-9.8) children.[19] Other national studies report similar findings.[3 21]
- Nationally, the difference in the prevalence of current asthma between Black, non-Hispanics and White, non-Hispanics was greater among children than adults. The findings in Massachusetts are consistent with this national trend.[3 19 22]

Figure 1.7: Three-year Average Annual Prevalence of Current Asthma among Children and Adults by Household Income, 2005-2007
Massachusetts Respondents



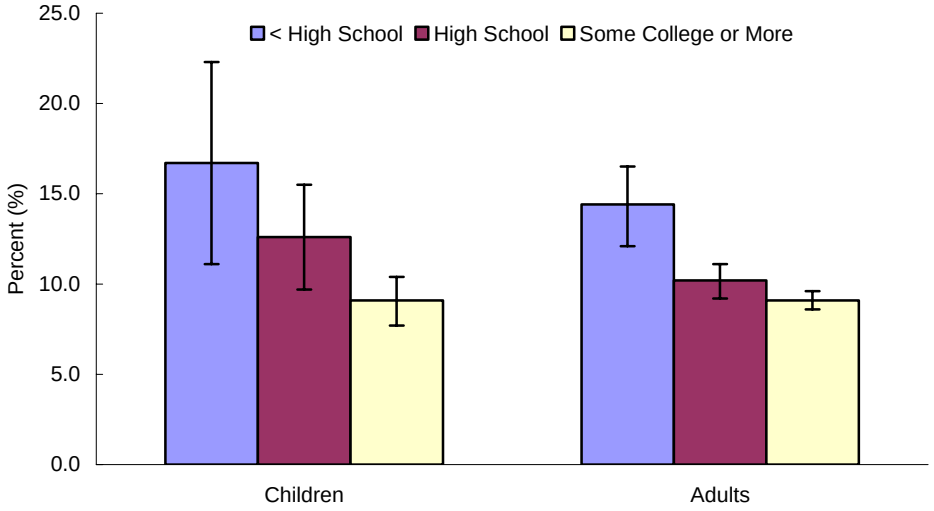
	Children			Adults		
Household Income	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
<$75,000	2,584	12.7	10.7-14.6	24,427	11.0	10.3-11.6
$75,000+	1,951	7.7	6.1-9.2	11,495	8.3	7.6-9.1

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Note: 9.3% of respondents reported 'unknown' or 'refused' to income status.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

- From 2005 through 2007, the three-year average annual prevalence of current asthma was higher among children (12.7% vs. 7.7%) and adults (11.0% vs. 8.3%) in households with incomes less than $75,000 compared to those in households with incomes $75,000 or greater.

Figure 1.8: Three-year Average Annual Prevalence of Current Asthma among Children and Adults by Educational Attainment of the Adult Respondent, 2005-2007

Massachusetts Respondents

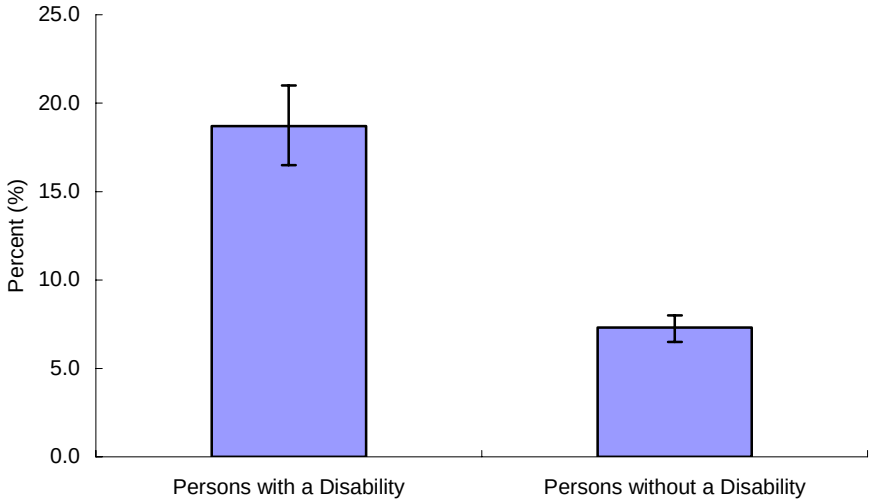


	Children			Adults		
Educational Attainment	**Sample Size[1]**	**%[2]**	**95% CI[3]**	**Sample Size[1]**	**%[2]**	**95% CI[3]**
< High School	439	16.7	11.1-22.3	4,355	14.4	12.1-16.5
High School	1,184	12.6	9.7-15.5	11,654	10.2	9.2-11.1
Some College or More	3,396	9.1	7.7-10.4	26,723	9.1	8.6-9.6

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health.

- Adults with some college or more were less likely to report current asthma than adults who did not graduate from high school (9.1% vs. 14.4). A similar pattern occurred among children (9.1% vs. 16.7%) based on the educational attainment of the adult respondent.
- Nationally, in 2007, the prevalence of current asthma among adults was higher among those who did not graduate from high school (10.3%) than those with a high school diploma (8.3%), some college (8.9%), and a college degree (7.3%).[18]

Figure 1.9: Three-year Average Annual Prevalence of Current Asthma among Adults by Disability Status, 2005-2007
Massachusetts Respondents Ages 18+ Years

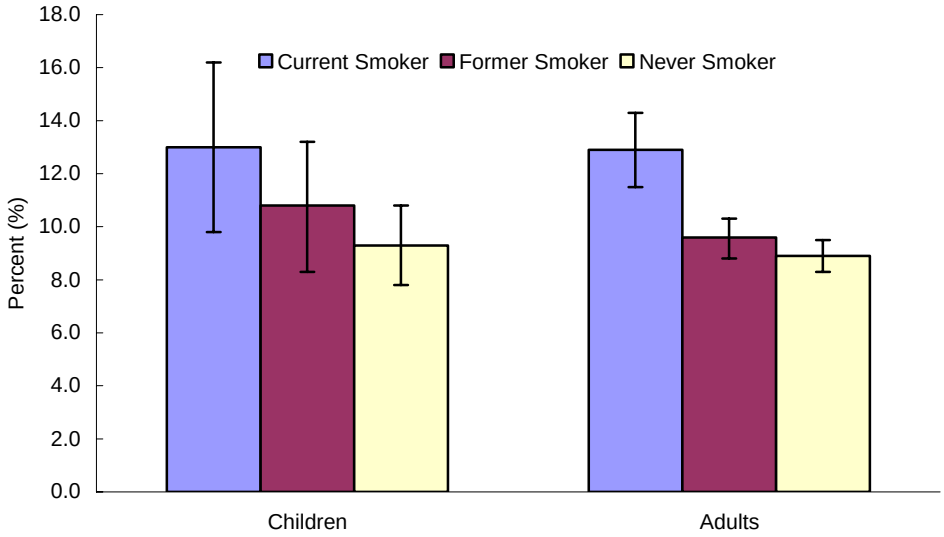


	Sample Size[1]	%[2]	95% CI[3]
Persons with a Disability[4]	3,859	18.7	16.5-21.0
Persons without a Disability	11,013	7.3	6.5-8.0

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] All respondents were asked about disabilities and activity limitations. Respondents were classified as having a disability or limitation if, for at least one year, 1) they had an impairment that limited activities or caused cognitive difficulties, 2) they used special equipment or required help from others to get around, or 3) reported a disability of any kind. Those who answered yes to one or more of the conditions above but had been limited by their disability for less than one year were excluded.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health.

- Among Massachusetts adults with a disability, the average annual prevalence of current asthma was higher compared to those without a disability (18.7% vs. 7.3%).
- See Figure 1.14 for data on the prevalence of asthma among middle school and high school students with a disability.

Figure 1.10: Three-year Average Annual Prevalence of Current Asthma among Children and Adults by Smoking Status of the Adult Respondent, 2005-2007
Massachusetts Respondents



Smoking Status of the Adult	Children			Adults		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Current Smoker[4]	971	13.0	9.8-16.2	7,565	12.9	11.5-14.3
Former Smoker[5]	1,132	10.8	8.3-13.2	13,490	9.6	8.8-10.3
Never Smoker[6]	2,910	9.3	7.8-10.8	21,600	8.9	8.3-9.5

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] A current smoker was defined as someone who has smoked at least 100 cigarettes in their lifetime and who currently smokes either some days or everyday.
[5] A former smoker was defined as someone who has smoked at least 100 cigarettes in their lifetime and who is not currently smoking.
[6] A never smoker was defined as someone who reported not having smoked at least 100 cigarettes during their lifetime.
Data Source: 2005-2007 MA Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health.

- From 2005 through 2007, the three-year average annual prevalence of current asthma among Massachusetts children in households of current smokers was 13.0%; in households of former smokers, 10.8%; of never smokers, 9.3%.
- During this time period, the prevalence of current asthma among adults was higher among those were current smokers (12.9%) than former smokers (9.6%) and never smokers (8.9%).
- From 2000 through 2007, the prevalence of current asthma among adults who were current smokers increased 8.7% from 11.5% to 12.5% in Massachusetts (ρ=0.786, p=0.021) (data available in Appendix B). The prevalence of current asthma remained stable among former smokers and never smokers from 2000 through 2007.

Table 1.1: Three-year Average Annual Prevalence of Lifetime and Current Asthma among Children by Asthma Status of the Adult Respondent, 2005-2007
Massachusetts Respondents Ages 0-17 Years

	Lifetime Asthma (Child)			Current Asthma (Child)		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Overall	5,045	14.4	13.0-15.8	5,026	10.3	9.1-11.5
Adult Asthma Status						
Ever Had Asthma	842	26.9	22.6-31.2	840	22.0	17.9-26.0
Currently Have Asthma	582	30.7	25.3-36.2	580	26.2	21.0-31.4

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2005-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

- From 2005 through 2007, the three-year average annual prevalence of lifetime asthma was higher among children with an adult respondent also reporting lifetime or current asthma (26.9% and 30.7%, respectively) than the prevalence of lifetime asthma among children in the overall population (14.4%).
- Similarly, the prevalence of current asthma was higher among children with an adult respondent also reporting lifetime or current asthma (22.0% and 26.2%, respectively) compared to the prevalence of current asthma among children in the overall population (10.3%).

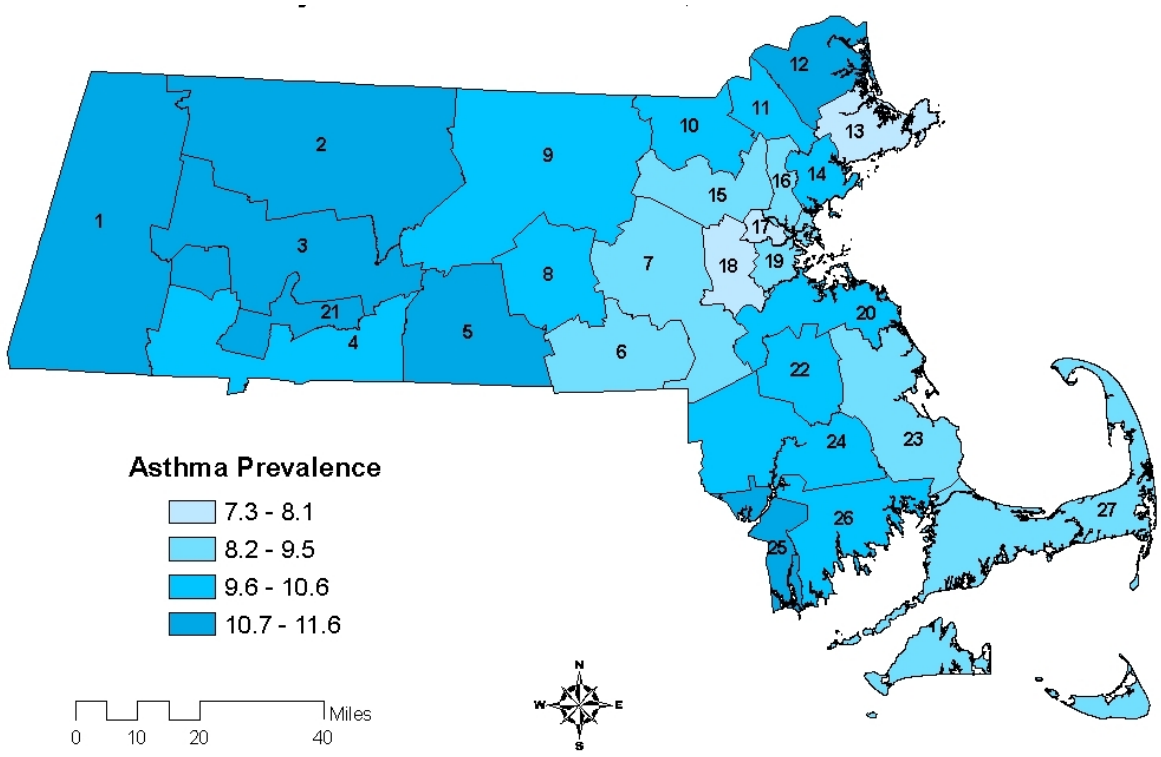
Table 1.2: Age of First Diagnosis of Asthma among Massachusetts Adults and Children with Lifetime Asthma, 2006-2007
Massachusetts Residents

	Sample Size[1]	%[2]	95% CI[3]
Age of First Diagnosis: Adults[4]	587		
< 5 years		11.2	6.3-16.2
5-17 years		39.9	31.7-48.1
18+ years		48.9	41.4-56.4
Age of First Diagnosis: Children[4]	168		
< 5 years		59.3	48.5-70.1
5-17 years		40.7	29.9-51.5

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] All respondents who reported ever having asthma were asked how old they were when they were first told by a doctor, nurse, or other health care professional that they had asthma.
Data Source: 2006-2007 Massachusetts Adult and Child Asthma Call-back Survey, Massachusetts Department of Public Health

- While many people are diagnosed with asthma in childhood, it can develop and manifest at anytime across the lifespan.
- Among Massachusetts adults with lifetime asthma, 48.9% were diagnosed as adults.

Map 1.1: Five-year Average Annual Prevalence of Current Asthma among Adults by Community Health Network Area (CHNA) of Residence, 2003-2007
Massachusetts Respondents Ages 18+ Years



Data Source: 2003-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

- From 2003 through 2007, the five-year average annual prevalence of current asthma among adults in Massachusetts was 9.8%.
- The prevalence of current asthma among adults ranged from a high of 11.6% in the CHNA 1: Community Health Network of Berkshire to a low of 7.3% in the CHNA 18: West Suburban Health Network.
- No CHNA had a prevalence of current asthma among adults that differed significantly than the overall Massachusetts prevalence.
- See Map 1.2 for the prevalence of asthma among Massachusetts children by geography.

Map 1.1 (continued): Five-year Average Annual Prevalence of Current Asthma among Adults by Community Health Network Area (CHNA) of Residence, 2003-2007

Massachusetts Respondents Ages 18+ Years

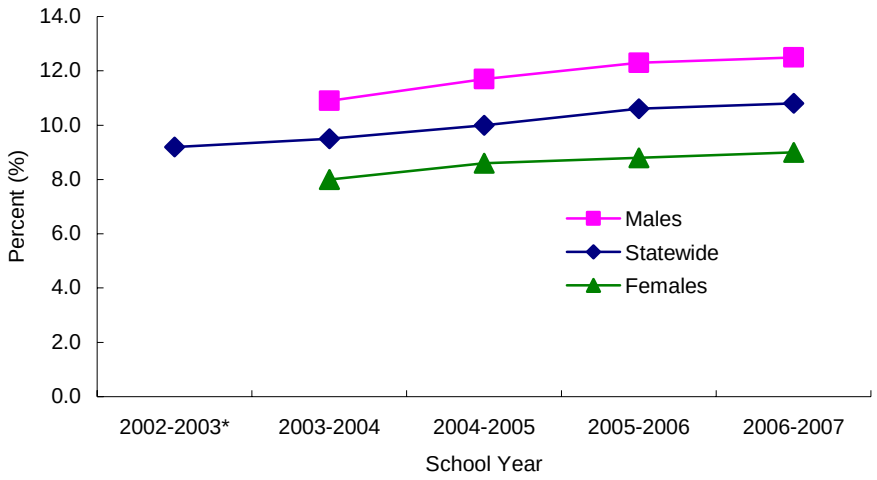
Community Health Network Area (CHNA)	Sample Size[1]	%[2]	95% CI[3]
1. Community Health Network of Berkshire	996	11.6	8.9-14.3
2. Upper Valley Health Web (Franklin County)	688	11.1	8.0-14.3
3. Partnership for Health in Hampshire County (Northampton)	988	11.0	8.6-13.4
4. The Community Health Connection (Springfield)	5,013	10.0	8.9-11.1
5. Community Health Network of Southern Worcester County	800	11.3	8.2-14.4
6. Community Partners for Health (Milford)	932	9.5	7.3-11.8
7. Community Health Network of Greater Metro West (Framingham)	2,154	8.7	7.2-10.3
8. Common Pathways (Worcester)	4,998	10.3	8.9-11.7
9. Community Health Network of Central Massachusetts	1,614	10.6	8.7-12.4
10. Greater Lowell Community Health Network	4,176	10.4	8.7-12.1
11. Greater Lawrence Community Health Network	4,664	10.5	9.0-11.9
12. Greater Haverhill Community Health Network	842	11.0	7.5-14.4
13. Greater Beverly/ Gloucester Community Health Network	789	8.1	5.7-10.6
14. North Shore Community Health Network	1,338	10.2	8.2-12.2
15. Northwest Suburban Health Alliance	1,337	8.7	6.9-10.5
16. North Suburban Health Alliance (Medford/Malden/Melrose)	1,238	9.5	7.6-11.5
17. Greater Cambridge/Somerville Community Health Network	1,395	7.9	6.2-9.6
18. West Suburban Health Network (Newton/Waltham)	1,420	7.3	5.6-8.9
19. Alliance for Community Health (Boston/Chelsea/Revere/Winthrop)	6,942	9.3	8.4-10.2
20. Blue Hills Community Health Alliance (Quincy)	1,892	10.2	8.4-12.0
21. Community Health Network of Chicopee-Holyoke-Ludlow-Westfield	875	11.4	8.7-14.2
22. Greater Brockton Community Health Network	1,032	10.3	8.0-12.7
23. South Shore Community Health Network	999	9.0	6.7-11.4
24. Greater Attleboro-Taunton Health Education	1,292	10.0	7.8-12.2
25. Partners for Healthier Communities (Fall River)	3,771	11.5	10.0-12.9
26. Greater New Bedford Community Health Network	4.417	10.1	8.6-11.7
27. Cape Cod and Islands Community Health Network	1,896	9.1	7.4-10.7
Massachusetts Total	58,545	9.8	9.4-10.1

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence interval.
Data Source: 2003-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

Pediatric Asthma Surveillance

The Pediatric Asthma Surveillance program, as part of the Environmental Public Health Tracking project at the MDPH Bureau of Environmental Health, tracks the prevalence of asthma among school children in grades Kindergarten through 8th. At each school, the school nurse abstracts data from school health records and counts the number of students with a documented history of asthma. The MDPH Bureau of Environmental Health estimates the prevalence of lifetime asthma from these data. Additional details are described in a previously published report.[24]

Figure 1.11: Trend in Prevalence of Lifetime† Asthma among Elementary and Middle School Students by Gender, 2002/2003 – 2006/2007 School Year
Massachusetts Students in Grades Kindergarten through 8th

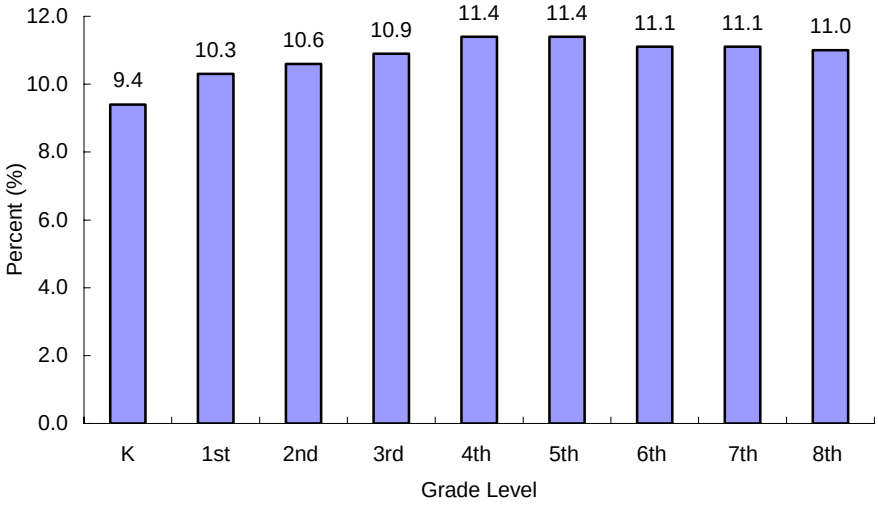


	Male		Female		Statewide	
School Year	**%**	**95% CI[1]**	**%**	**95% CI[1]**	**%**	**95% CI[1]**
2002-2003*	NA	NA	NA	NA	9.2	9.1-9.3
2003-2004	10.9	NA	8.0	NA	9.5	9.4-9.6
2004-2005	11.7	11.6-11.8	8.6	8.5-8.7	10.0	9.9-10.1
2005-2006	12.3	12.2-12.4	8.8	8.7-8.9	10.6	10.5-10.7
2006-2007	12.5	12.4-12.6	9.0	8.9-9.1	10.8	10.7-10.8

† Lifetime asthma in the Pediatric Asthma Surveillance is a combination measure for the prevalence of lifetime and current asthma, see Appendix A for methodology.
* Only 44% of schools were asked to participate.
[1] 95% Confidence Interval.
NA=Data not available.
Data Source: Pediatric Asthma Surveillance, Bureau of Environmental Health, Massachusetts Department of Public Health

- According to the Pediatric Asthma Surveillance program, the prevalence of asthma among children in grades Kindergarten through 8th increased 17.4% (ρ=1.000, $p<0.0001$) from the 2002-2003 school year through the 2006-2007 school year.

Figure 1.12: Prevalence of Lifetime† Asthma among Elementary and Middle School Students by Grade Level, 2006/2007 School Year
Massachusetts Students in Grades Kindergarten through 8th

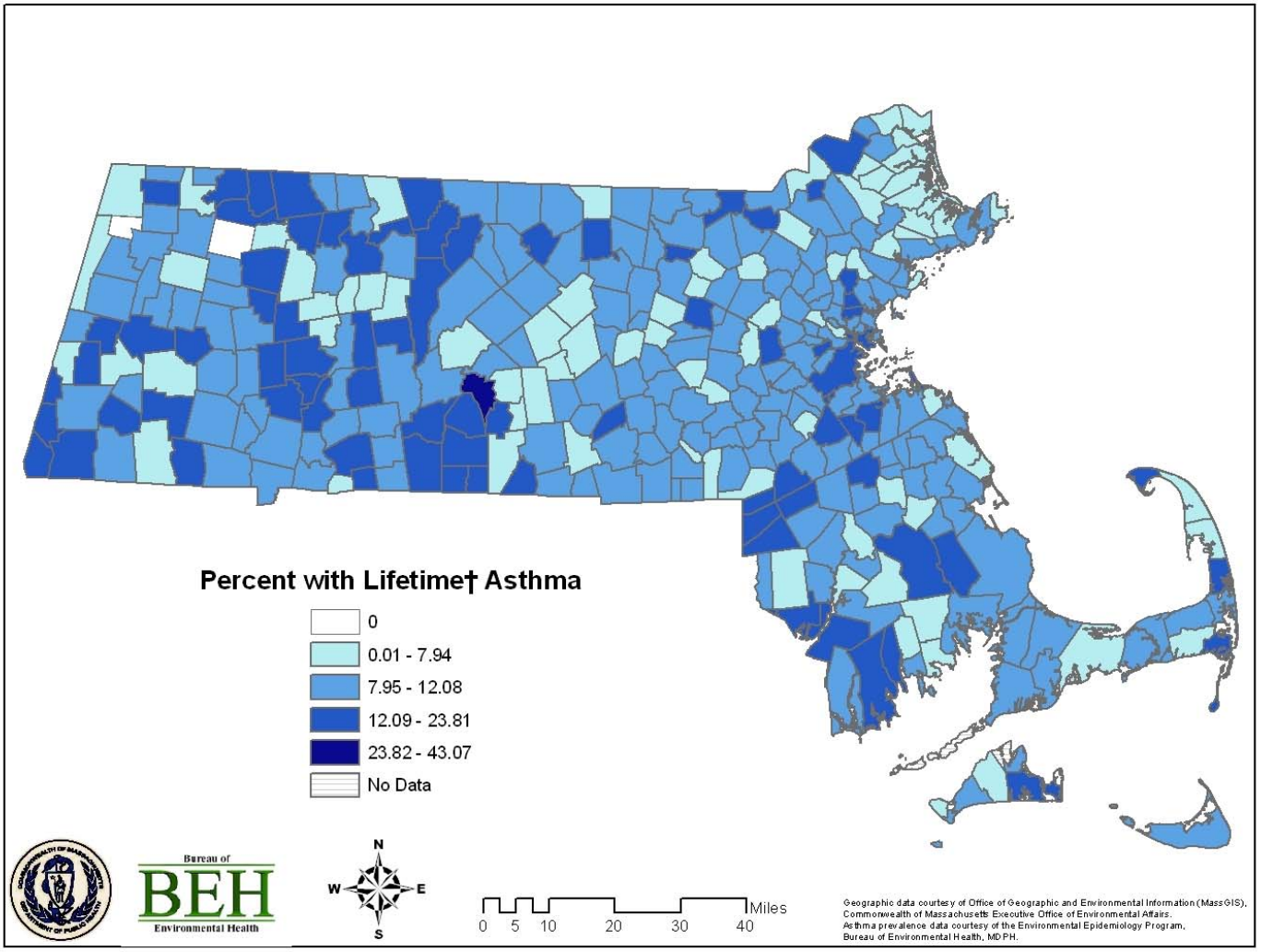


Grade	Total	
	%	95% CI[1]
Kindergarten	9.4	9.2-9.6
1st	10.3	10.0-10.5
2nd	10.6	10.4-10.8
3rd	10.9	10.7-11.2
4th	11.4	11.2-11.6
5th	11.4	11.3-11.7
6th	11.1	10.8-11.3
7th	11.1	10.8-11.3
8th	11.0	10.8-11.2

† Lifetime asthma in the Pediatric Asthma Surveillance is a combination measure for the prevalence of lifetime and current asthma, see Appendix A for methodology.
[1] 95% Confidence Interval.
Data Source: Pediatric Asthma Surveillance, Bureau of Environmental Health, Massachusetts Department of Public Health

- According to the Pediatric Asthma Surveillance program, asthma prevalence among children in 2006-2007 generally increased by grade level from Kindergarten through grade 5 (9.4% in Kindergarten to 11.4% in 5th grade). After grade 5, prevalence leveled off at approximately 11%.

Map 1.2: Prevalence of Lifetime† Asthma among Elementary and Middle School Children by Community of Residence, 2006/2007 School Year
Massachusetts Students in Grades Kindergarten through 8th



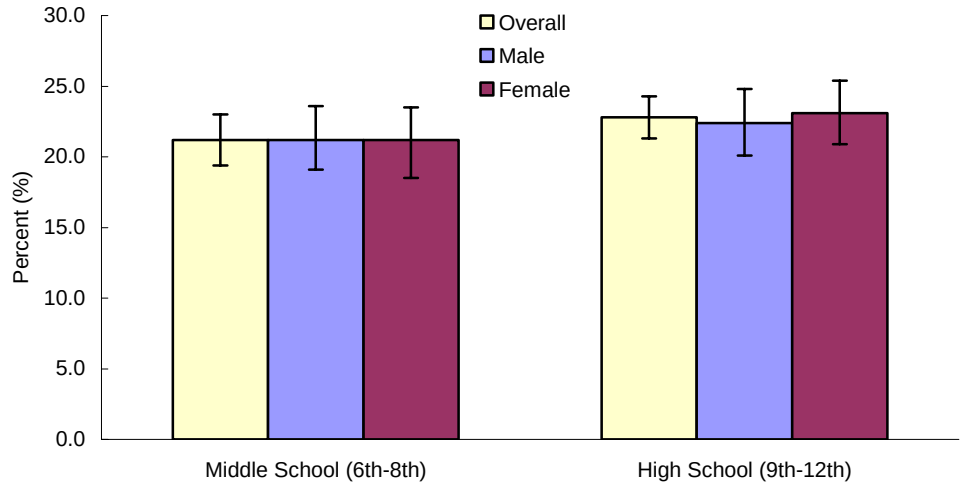
† Lifetime asthma in the Pediatric Asthma Surveillance is a combination measure for the prevalence of lifetime and current asthma, see Appendix A for methodology.
Data table available in Appendix B.
Data Source: Pediatric Asthma Surveillance, Bureau of Environmental Health, Massachusetts Department of Public Health

- According to the Pediatric Asthma Surveillance program, asthma prevalence among children in 2006-2007 in grades Kindergarten through 8th was 10.8%**.**
- The prevalence of asthma ranged from a high of 43.1% in West Brookfield to a low of 0.0% in Hawley and New Ashford. The community with the next lowest prevalence of asthma was in Lincoln (3.1%).
- 47 communities had a prevalence of asthma that was higher than the overall Massachusetts prevalence among this K-8th grade population.

Massachusetts Youth Health Survey

The Massachusetts Youth Health Survey, administered by MDPH, collects self-reported data from middle and high school students (grades 6-12) in Massachusetts public schools on a wide variety of health and lifestyle issues, including the prevalence of ever having a diagnosis of asthma. It is conducted every other year by the MDPH in collaboration with the Massachusetts Department of Elementary and Secondary Education (ESE). The 2007 survey refers to the 2006-2007 school year. Additional details are described in a previously published report.[25]

Figure 1.13: Prevalence of Lifetime Asthma among Middle and High School Youth by Grade Level and Gender, 2007



	Middle School (6th-8th)			High School (9th-12th)		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Overall	2,573	21.2	19.4-23.0	3,047	22.8	21.3-24.3
Gender						
Male	1,322	21.2	19.1-23.4	1,526	22.4	20.1-24.8
Female	1,251	21.2	18.5-23.9	1,521	23.1	20.9-25.4

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2007 Massachusetts Youth Health Survey, Massachusetts Department of Public Health

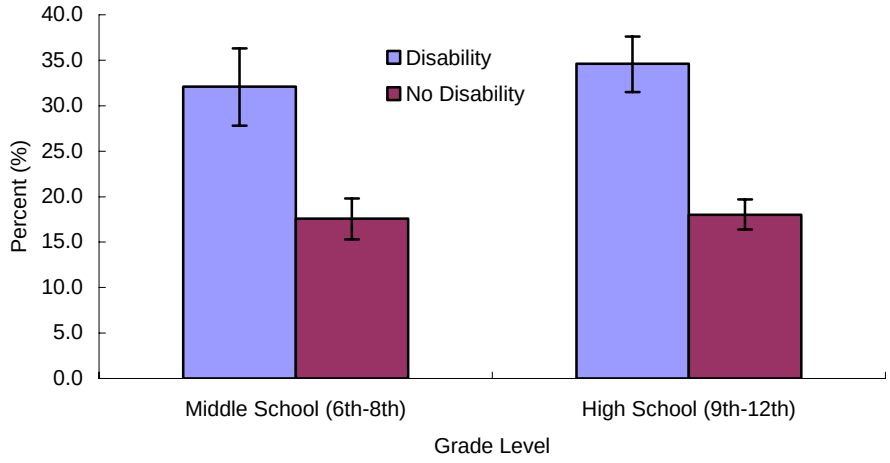
Overall

- According to the 2007 Massachusetts Youth Health Survey, the prevalence of lifetime asthma among middle school students was 21.2% and among high school students was 22.8%.
- Nationally, in 2007, the prevalence of lifetime asthma among high school students was 20.3%.[26]

Gender

- The prevalence of lifetime asthma was similar for males and females in middle school and high school in Massachusetts.
- Nationally, in 2007, the prevalence of lifetime asthma was similar for males (19.9%) and females (20.7%) in high school.[26]

Figure 1.14: Prevalence of Lifetime Asthma among Middle and High School Youth by Disability Status, 2007



	Middle School (6th-8th)			High School (9th-12th)		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Students with a disability[4]	2,611	32.1	27.8-36.3	3,101	34.6	31.5-37.6
Students without a disability	2,611	17.6	15.3-19.8	3,101	18.0	16.4-19.7

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] Respondents were classified as having a disability if they answered "yes" to any of the following: questions: 1) Do you have any physical disabilities or long-term health problems?, 2) Do you have any long-term emotional problems or learning disabilities?", 3) Would other people consider you to have ANY disability or long-term health problems, including physical health, emotional, or learning problems?, or 4) Are you limited in any activities because of ANY disability or long-term health problems, including physical health, emotional, or learning problems?
Note: 20% of respondents reported 'unknown' to the question about disability.
Data Source: 2007 Massachusetts Youth Health Survey, Massachusetts Department of Public Health

- According to the 2007 Massachusetts Youth Health Survey, the prevalence of lifetime asthma was higher among middle school and high school students with a disability compared to students without a disability.

Section 2. Factors Associated with Asthma Management

The goal of effective management of asthma is to allow children and adults with asthma to function with minimal restrictions and enjoy a good quality of life. There are many ways to describe how well asthma is being managed, such as whether the goals of therapy and standards of asthma care are met, symptom frequency, activity limitations, nighttime symptoms, knowledge of the disease, or exposure to environmental triggers.

Massachusetts collects information regarding asthma management through the Asthma Call-back Survey (ACS), a follow-up survey to the BRFSS for respondents who report that they or their child has lifetime asthma. The limited sample size for adults and especially children restricted the subgroup analyses. Data for multiple years were combined to derive more stable estimates.

This section presents data from the ACS on a variety of factors associated with management and classifications for asthma control among adults with current asthma, followed by a subset of these data among children with current asthma. The EPR3 guidelines define control as the degree to which the manifestations of asthma are minimized and the goals of therapy are met.[11] The grid below summarizes the factors used to classify asthma control in individuals age 12 years and older according to the EPR3 Guidelines.[11]

Components of Asthma Control		**Classification of Asthma Control (≥12 years of age)**		
		Well Controlled	**Not Well Controlled**	**Very Poorly Controlled**
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime Awakenings	≤2x/month	1-3x/week	≥4x/week
	Short-acting beta2-agonist use for symptom control	≤2 days/week	>2 days/week	Several times per day
	FEV1 or peak flow	>80% predicted/personal best	60-80% predicted/personal best	<60% predicted/personal best
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year	
	Progressive loss of lung function	Evaluation requires long-term follow-up care		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		

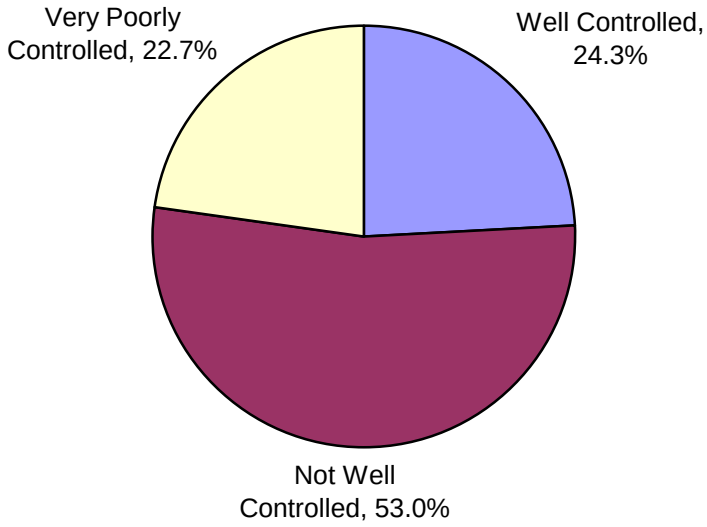
Any measure that has a corresponding national benchmark for improving asthma management through the Healthy People 2010 initiative is denoted with “HP2010”.

This section also includes findings on school-based asthma management activities carried out by school nurses based on data collected by the Massachusetts Essential School Health Services program data.

Finally, this section presents the prevalence of appropriate medication use for the MassHealth managed care population with persistent asthma from the MassHealth Health Plan and Employer Data and Information Set (HEDIS). Excerpts are presented from the report called, "Use of Appropriate Medications for People with Asthma, HEDIS 2008".[27]

Additional details about the methodology, survey questions, considerations of each data source, and the methods used to classify asthma control based on the criteria set forth by the national guidelines, are outlined in Appendix A. See Section 6 for more information on Healthy People 2010 Objectives.

Figure 2.1: Level of Asthma Control among Adults with Current Asthma, 2006-2007
Massachusetts Respondents Ages 18+ Years

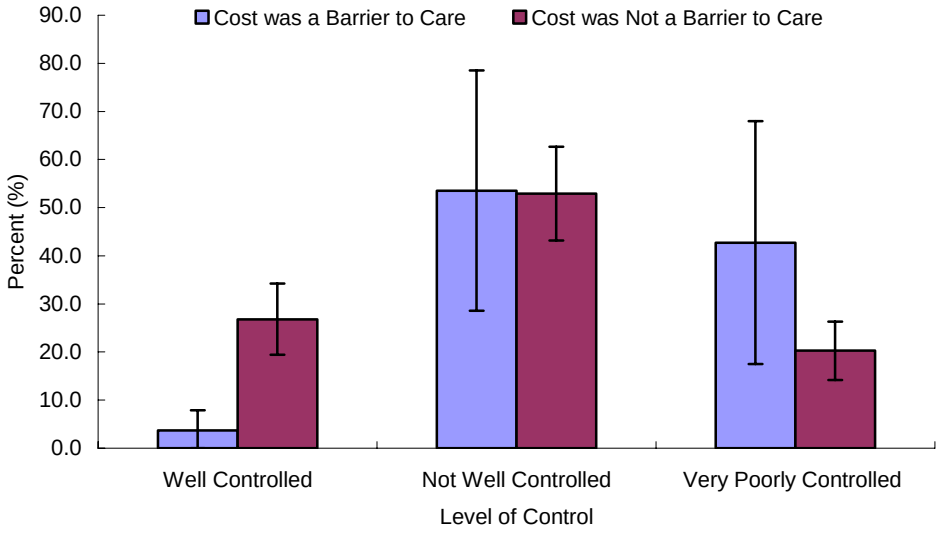


Level of Asthma Control	Sample Size[1]	%[2]	95% CI[3]
Asthma Control[4]	402		
Well Controlled		24.3	17.7-30.8
Not Well Controlled		53.0	44.0-62.1
Very Poorly Controlled		22.7	16.2-29.1

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence interval.
[4] Definition of variable is available in Appendix A.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Regardless of severity, the ultimate goal for individuals with asthma is to have well-controlled asthma. In Massachusetts, 24.3% of adults with current asthma were classified has having well-controlled asthma while 75.7% were classified has having not well controlled or very poorly controlled asthma.

Figure 2.2: Level of Asthma Control among Adults with Current Asthma by Cost as a Barrier to Care, 2006-2007
Massachusetts Respondents Ages 18+ Years



	Sample Size[1]	%[2]	95% C.I.[3]
Overall, Cost was a Barrier to Care[4]	433	11.6	6.4-16.8
Cost was a Barrier to Care	60		
Well Controlled		3.7*	0.0-7.9
Not Well Controlled		53.5	28.6-78.5
Very Poorly Controlled		42.7	17.5-68.0
Cost was Not a Barrier to Care	334		
Well Controlled		26.8	19.4-34.2
Not Well Controlled		52.9	43.2-62.7
Very Poorly Controlled		20.3	14.2-26.3

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to any of the following: 1) "Was there a time in the past 12 months when you needed to see your primary care doctor for your asthma but could not because of the cost?", 2)"Was there a time in the past 12 months when you were referred to a specialist for asthma but could not go because of the cost?", or 3)"Was there time in the past 12 months when you needed to buy medication for your asthma but could not because of the cost?"
* Relative Standard Error is > 50% therefore the results should be interpreted with caution due to the instability of the estimate.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Among Massachusetts adults with current asthma, 11.6% reported that cost was a barrier to care.
- Of those that reported cost was a barrier to care, 3.7% had well-controlled asthma, 53.5% had not well controlled asthma, and 42.7% had very poorly controlled asthma.
- Of those that reported cost was not a barrier to care, 26.8% had well-controlled asthma, 52.9% had not well controlled asthma, and 20.3% had very poorly controlled asthma.

Table 2.1: Measures of Impairment among Adults with Current Asthma, 2006-2007
Massachusetts Respondents Ages 18+ Years

Measures of Impairment	Sample Size[1]	%[2]	95% CI[3]
Had symptoms of asthma, past 30 days[4]	444		
0 days		32.4	24.4-40.5
1-8 days		22.8	17.0-28.6
9-29 days		22.2	13.3-31.2
30 days		22.5	14.9-30.1
Sleep disrupted by asthma, past 30 days[5]	435		
0 days		76.0	69.1-83.0
1-2 days		6.0*	1.0-11.1
3-12 days		10.1	6.0-14.3
13-30 days		7.9	4.5-11.2
Completely symptom-free, past 2 weeks[6]	439		
0 days		24.8	16.2-33.5
1-10 days		29.5	21.2-37.7
11-14 days		45.7	37.0-54.4
Asthma attack or episode, past 12 months[7]	444	52.9	44.1-61.6
Limit usual activities due to asthma, past 12 months[8]	442		
Not at all		37.5	28.9-46.1
A little		40.4	31.9-48.8
A moderate amount		17.4	9.6-25.2
A lot		4.7	2.2 - 7.1
Unable to work or carry out usual activities due to asthma, past 12 months,[9] HP2010	426		
0 days		78.1	72.1-84.0
1-10 days		13.0	8.3-17.8
11+ days		8.9	5.3-12.5
Mean # of days (range: 0-365 days)		7.5	3.0-12.1
Median # of days		0.0	
Had emergency department visits or other urgent care for asthma, past 12 months[10]	445		
0 visits		85.7	80.1-91.3
1 visit		5.8*	1.5-10.1
≥2 visits		8.5	4.6-12.3
Had ≥1 hospital admission for asthma, past 12 months[11]	445	4.4	1.8-7.0

[1] Sample size is the number of respondents who answered the corresponding question(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "During the past 30 days, on how many days did you have any symptoms of asthma?"
[5] "During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?"
[6] "During the past 2 weeks, on how many days were you completely symptom-free that is no coughing, wheezing, or other symptoms of asthma?"
[7] "During the past 12 months, have you had an episode of asthma or an asthma attack?"
[8] "During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?"
[9] "During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?"
[10] "During the past 12 months, have you had to visit an emergency room or urgent care center because of your asthma?" and "During the past 12 months how many times did you visit an emergency room or urgent care center because of you asthma?"
[11] "During the past 12 months, have you had to stay overnight in a hospital because of your asthma?" and "During the past 12 months how many different times did you stay in any hospital overnight or longer because of your asthma?"
Note: Symptoms of asthma include cough, wheezing, shortness of breath, chest tightness and phlegm production when you don't have a cold of respiratory infections.
* Relative Standard Error is > 30% therefore the results should be interpreted with caution due to the instability of the estimate.
Note: Subcategories were selected to correspond with the EPR-3 Guidelines when possible.[11]

- From 2006 through 2007, 67.5% of Massachusetts adults with current asthma reported experiencing symptoms of asthma in the past 30 days.
    - 44.7% reported experiencing symptoms for 9 or more of the past 30 days, an average of more than twice a week.
- 24.0% of adults with current asthma reported that asthma symptoms made it difficult to sleep in the past 30 days.
    - 18.0% reported that asthma symptoms made it difficult for them to sleep for three or more nights in the past 30 days.
- 57.8% of Massachusetts adults with current asthma reported they limited their usual activities a little to a moderate amount. 4.7% limited their usual activities a lot.
- 21.9% of Massachusetts adults with current asthma were unable to work or carry out normal activities for at least one day during the past 12 months due to asthma.
    - 13.0% of adults with current asthma missed 1 to 10 days and 8.9% missed 11 or more days.
- On average, Massachusetts adults with current asthma were unable to work or carry out usual activities because of their asthma for 7.5 days in the past 12 months.
- 14.3% of adults with current asthma had 1 or more visits to the emergency room or urgent care or more and 4.4% had 1 or more hospital admissions for their asthma in the past 12 months.

Table 2.2: Prevalence of Asthma Self-Management Education among Adults with Current Asthma, 2006-2007
Massachusetts Respondents Ages 18+ Years

	Massachusetts			US	
Asthma Self-Management Education	**Sample Size[1]**	**%[2]**	**95% CI[3]**	**%[2]**	**95% CI[3]**
Taken a class on asthma management,[4] HP2010	442	5.1	2.9-7.4	12.4	10.8-14.3
Received an asthma action plan,[5] HP2010	434	33.4	23.9-42.9	33.6	31.2-36.1
Taught to use a peak flow meter,[6] HP2010	442	50.7	41.8-59.6	45.0	42.4-47.8
Taught to recognize early signs of an asthma attack,[7] HP2010	432	65.5	57.5-73.4	55.1	52.5-57.6
Taught to respond to an asthma attack,[8] HP2010	436	79.8	73.4-86.3	64.8	62.4-67.2
Taught how to use a prescribed inhaler,[9] HP2010	422	97.6	95.7-99.5	NA	NA
Advised to change aspects of home, school or work[10]	439	46.5	37.6-55.4	47.4	44.9-50.0

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to "Have you ever taken a course or class on how to manage your asthma?"
[5] "Yes" to "Has a doctor or other health professional ever given you an asthma action plan?"
[6] "Yes" to "Has a doctor or other health professional ever taught you how to use a peak flow meter to adjust your daily medications?"
[7] "Yes" to "Has a doctor or other health professional ever taught you how to recognize early signs or symptoms of an asthma episode?"
[8] "Yes" to "Has a doctor or other health professional ever taught you what to do during an asthma attack or episode?"
[9] "Yes" to "Did a doctor or other health professional show you how to use the inhaler?" or "Did a doctor or health professional watch you use the inhaler?"
[10] 'Yes" to "Has a health professional ever advised you to change things in your home, school, or work to improve your asthma?"
NA = Data not available.
Data Source: MA Data: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health, US Data: 2003 National Health Interview Survey, National Center for Health Statistics

- From 2006 through 2007, approximately one-third of Massachusetts adults with current asthma report having ever received an asthma action plan.
- Less than two-thirds have been taught how to recognize early signs and symptoms of an asthma attack.
- Compared to the US, the percent of Massachusetts adults with current asthma that know how to respond to an asthma attack (79.8%) was higher than the national average (64.8%).[28]
- Compared to the US, the percent of Massachusetts adults with current asthma that have taken a class on asthma management (5.1%) was lower than the national average (12.4%).[28]

Table 2.3: Prevalence of Proactive Health Care Utilization for Asthma among Adults with Current Asthma, 2006-2007
Massachusetts Respondents Ages 18+ Years

Proactive Health Care Utilization	Sample Size[1]	%[2]	95% CI[3]
Had routine checkup for asthma, past 12 months[4]	441		
0 checkups		37.5	28.4-46.7
1 checkup		32.5	24.5-40.5
≥2 checkups		30.0	22.2-37.7
Received flu vaccine, past 12 months[5]	453	**50.6**	**41.8-59.5**
Ages 18-64 years		45.4	35.6-55.1
Ages 65+ years		80.9	67.1-94.7

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "During the past 12 months how many times did you see a doctor or health professional for a routine checkup for your asthma?"
[5] "Yes" to "During the past 12 months, have you had a flu shot?" or "During the past 12 months, have you had a flu vaccine that was sprayed in your nose?"
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health.

- Among Massachusetts adults with current asthma, 62.5% had 1 or more routine checkups for their asthma in the past 12 months.
    - This means, 37.5% did not have any routine checkups in the past 12 months.
- Clinical guidelines recommend that all people with asthma should receive a flu vaccine.[11] Approximately half (50.6%) of Massachusetts adults with current asthma received a flu vaccination in the past 12 months.

Table 2.4: Prevalence of Medication Use among Adults with Current Asthma, 2006-2007

Massachusetts Respondents Ages 18+ Years

Medication Use	Sample Size[1]	%[2]	95% CI[3]
Used any prescription asthma medication, past 3 months[4]	453	67.6	58.5-76.6
Used inhaled corticosteroid, past 3 months[5]	453	35.7	27.6-43.8
Used inhaled long-acting beta2-agonist, past 3 months[6]	453	23.0	16.7-29.4
Used leukotriene modifier, past 3 months[7]	453	12.1	7.5-16.6
Used inhaled anti-inflammatory, past 3 months[8]	453	*	
Used inhaled anticholinergic, past 3 months[9]	453	5.3	2.9-7.7
Used inhaled short-acting beta2-agonists, past 3 months[10]	453	48.2	39.5-60.0
Used any inhaled prescription asthma medication, past 3 months[11]	430	65.1	56.0-74.2
Used a spacer (with inhaled prescription asthma medication)[12]	288	27.7	19.9-35.6

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to "In the past 3 months, _____" to any of the following:
Have you taken prescription asthma medicine using an inhaler?"
Have you taken prescription asthma medication in pill form?"
Have you taken prescription asthma medication in syrup form?"
Were any of your asthma medicines used with a nebulizer?"
[5] "One or more" inhaled corticosteroid in the past 3 months
[6] "One or more" inhaled long-acting beta2-agonists in the past 3 months
[7] "One or more" leukotriene modifier in the past 3 months
[8] "One or more" inhaled anti-inflammatory in the past 3 months
[9] "One or more" inhaled anticholinergic in the past 3 months
[10] "One or more" inhaled short-acting beta2-agonists in the past 3 months
[11] "One or more" inhaled prescription asthma medications in the past 3 months
[12] "Yes" to "Do you use a spacer with [list of medications taken with an inhaler]?"
* Relative Standard Error >60% and therefore was not reported
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

There are two major categories of medications used to treat asthma: long-term control medications and quick-relief medication. Examples of long-term control medication include corticosteroids, long-acting beta2-agonists, and leukotriene modifiers. Examples of quick-relief medication include short-acting beta2-agonists and anticholinergics.

- Of adults with current asthma, 35.7% reported using an inhaled corticosteroid in the past 3 months, 23.0% reported using an inhaled long-acting beta2-agonist, and 12.1% reported using a leukotriene modifier in the past 3 months.
- Approximately half (48.2%) of adults with current asthma reported using short-acting beta2-agonists in the past 3 months.
- Of those using any inhaled prescription asthma medication, 27.7% reported using a spacer.

Table 2.5: Prevalence of Co-morbid Conditions among Adults with Current Asthma, 2006-2007

Massachusetts Respondents Ages 18+ Years

Co-morbid Conditions	Sample Size[1]	%[2]	95% CI[3]
Chronic Bronchitis[4]	425	17.6	11.9-23.2
Emphysema[5]	431	6.4	3.2-9.5
Chronic Obstructive Pulmonary Disease (COPD)[6]	432	9.0	5.8-12.2
Any Respiratory Condition[7]	435	23.3	17.0-29.6
Depression[8]	433	35.2	26.0-44.4

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to "Have you been told by a doctor or health professional that you have chronic bronchitis?"
[5] "Yes" to "Have you been told by a doctor or health professional that you have emphysema?"
[6] "Yes" to "Have you been told by a doctor or health professional that you have chronic obstructive pulmonary disease also known as COPD?"
[7] "Yes" to any of the following: 1) "Have you ever been told by a doctor or health professional that you have chronic obstructive pulmonary disease also known as COPD?", 2)"Have you ever been told by a doctor or health professional that you have emphysema?", or 3) Have you ever been told by a doctor or health professional that you have chronic bronchitis?"
[8] "Yes" to "Have you ever been told by a doctor or health professional that you were depressed?"
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Among adults with current asthma, 23.3% reported a history of either chronic bronchitis, emphysema, or chronic obstructive pulmonary disease (COPD).
- 35.2% of Massachusetts adults with current asthma also reported a diagnosis of depression.

Table 2.6: Prevalence of Environmental Triggers and Modifications in the Home among Adults with Current Asthma, 2006-2007
Massachusetts Respondents Ages 18+ Years

Environmental Triggers in the Home	Sample Size[1]	%[2]	95% CI[3]
Has pets inside home[4]	443	59.3	51.0-67.5
Carpeting or rugs in bedroom[5]	443	58.5	50.1-66.8
Pets allowed in bedroom[6]	453	48.8	39.9-57.7
Gas used for cooking[7]	442	41.8	33.3-50.3
Wood burning fireplace/stove[8]	443	24.0	15.6-32.4
Smoking inside the home, past week[9]	443	18.2	9.8-26.6
Mold inside the home, past 30 days[10]	443	16.4	7.9-24.9
Mice or rats inside the home, past 30 days[11]	443	7.9	4.2-11.6
Cockroaches inside the home, past 30 days[12]	443	3.7*	0.0-7.6
Gas fireplace or unvented gas stove[13]	442	3.5**	1.1-5.8
Modifications			
Exhaust fan used in the bathroom[14]	439	56.6	47.2-66.0
Exhaust fan in kitchen regularly used[15]	441	53.2	44.3-62.2
Sheets and pillowcases washed in hot water[16]	434	50.0	41.1-59.0
Dehumidifier regularly used[17]	443	34.2	25.7-42.7
Mattress cover used[18]	435	32.6	25.9-39.3
Pillow cover used[19]	440	29.4	22.7-36.0
Air cleaner or purifier regularly used[20]	441	25.4	17.3-33.4

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to Does your household have pets such as dogs, cats, hamsters, birds or other feathered or furry pets that spend time indoors?
[5] "Yes" to "Do you have carpeting or rugs in your bedroom?"
[6] "Yes" to " Are pets allowed in your bedroom?"
[7] "Yes" to "Is gas used for cooking?"
[8] "Yes" to "Is a wood burning fireplace or wood burning stove used in your home?"
[9] "Yes" to "In the past week, has anyone smoked inside your home?"
[10] "Yes" to "In the past 30 days, has anyone seen or smelled mold or a musty odor inside your home?"
[11] "Yes" to "In the past 30 days, has anyone seen mice or rats inside your home?"
[12] "Yes" to "In the past 30 days, has anyone seen a cockroach inside your home?"
[13] "Yes" to "Are unvented gas logs, unvented gas fireplaces, or unvented gas stoves used in your home?"
[14] "Yes" to "In your bathroom, do you regularly use an exhaust fan that vents to the outside?"
[15] "Yes" to "Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?"
[16] "Hot" to "Are your sheets and pillowcases washed in cold, warm or hot water?"
[17] "Yes" to "Is a dehumidifier regularly used to reduce moisture inside your home?"
[18] "Yes" to "Do you use a mattress cover that is made especially for controlling dust mites?"
[19] "Yes" to "Do you use a pillow cover that is made especially for controlling dust mites?"
[20] "Yes" to "Is an air cleaner or purifier regularly used inside your home?"
* Relative Standard Error is > 50% therefore the results should be interpreted with caution due to the instability of the estimate.
** Relative Standard Error is >30% therefore the results should be interpreted with caution due to the instability of the estimate.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Environmental asthma triggers can cause an asthma episode or make asthma worse. Avoiding these triggers is necessary to successfully controlling a person's asthma. Among Massachusetts adults with current asthma, the most commonly reported environmental exposures in the home were pets (59.3%) and carpeting or rugs in the bedroom (58.5%).
- Use of an exhaust fan in the bathroom (56.6%) and in the kitchen (53.2%) was reported most often as an environmental modification among adults with current

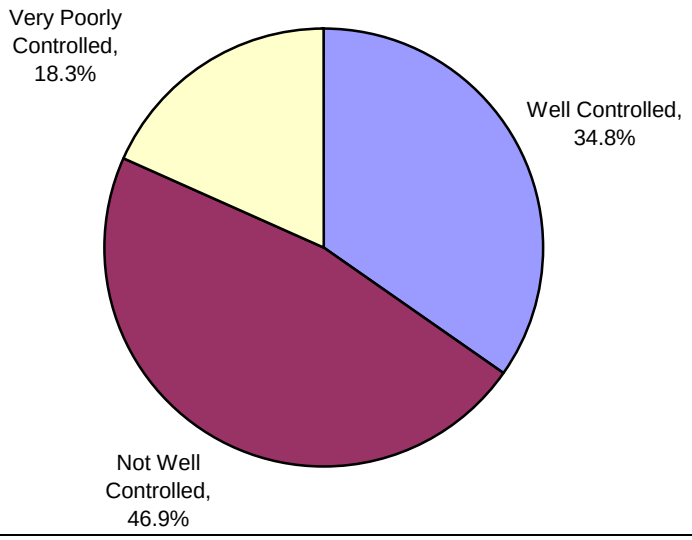
asthma. Regular use of an air cleaner or purifier was an environmental modification reported least often among adults with current asthma.

Asthma Management among Children

Data from the Child Asthma Call-back Survey are presented on a variety of factors associated with asthma management and classifications for asthma control among children with current asthma. The limited sample sizes for children restricted the subgroup analyses and therefore the analyses among children are not as extensive as those among adults.

Figure 2.3: Level of Asthma Control among Children with Current Asthma, 2006-2007

Massachusetts Respondents Ages 0-17 Years



	Sample Size[1]	%[2]	95% CI[3]
Overall Asthma Control[4]	107		
Well Controlled		34.8	21.8-47.8
Not Well Controlled		46.9	33.7-60.2
Very Poorly Controlled		18.3	9.5-27.1

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] Definition of variable is available in Appendix A.
Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health

- In Massachusetts, 34.8% of children with current asthma were classified has having well-controlled asthma while 65.2% were classified has having not well controlled or very poorly controlled asthma.

Table 2.7: Measures of Impairment among Children with Current Asthma, 2006-2007

Massachusetts Respondents Ages 0-17 Years

Measures of Impairment	Sample Size[1]	%[2]	95% CI[3]
Had symptoms of asthma, past 30 days[4]	110		
0 days		59.5	46.3-72.7
≥1 day		40.5	27.3-53.7
Sleep disrupted by asthma, past 30 days[5]	113		
0 days		83.1	73.2-93.0
≥1 day		16.9	7.0-26.8
Completely symptom-free, past 2 weeks[6]	113		
0-10 days		24.0	12.2-35.8
11-14 days		76.0	64.2-87.8
Asthma attack or episode, past 12 months[7]	111	44.2	31.3-57.0
Limit usual activities due to asthma, past 12 months[8]	112		
Not at all		49.1	36.1-62.1
A little		36.9	24.0-49.7
A moderate amount to a lot		14.0	6.3-21.7
Missed school or daycare due to asthma, past 12 months,[9] HP2010	104		
0 days		62.2	49.5-74.9
≥1 day		37.8	25.1-50.5
Mean # of days (Range: 0-60 days)		2.0	1.1-3.0
Median # of days		0.0	--
Had ≥1 emergency department visit, other urgent care, or hospital admission for asthma, past 1 months[10]	113	13.3	5.9-20.8

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "During the past 30 days, on how many days did [child] have any symptoms of asthma?"
[5] "During the past 30 days, on how many days did symptoms of asthma make it difficult for [child] to stay asleep?"
[6] "During the past 2 weeks, on how many days was [child] completely symptom-free that is no coughing, wheezing, or other symptoms of asthma?"
[7] "During the past 12 months, has [child] had an episode of asthma or an asthma attack?"
[8] "During the past 12 months, would you say [child] limited [his/her] usual activities due to asthma not at all, a little, a moderate amount, or a lot?"
[9] "During the past 12 months, about how many days or school did [child] miss because of his/her asthma?" or "During the past 12 months, about how many days of daycare did [child] miss because of his/her asthma?"
[10] "During the past 12 months, has [child] had to visit an emergency room or urgent care center because of his/her asthma?" and "During the past 12 months how many times did [child] visit an emergency room or urgent care center because of his/her asthma?" or "During the past 12 months, has [child] had to stay overnight in a hospital because of his/her asthma?" and "During the past 12 months how many different times did [child] stay in any hospital overnight or longer because of his/her asthma?"
Note: Subcategories were selected to correspond to the EPR-3 Guidelines when possible.[11] Subcategories were collapsed to derive more stable estimates when possible.
Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health

- 40.5% of Massachusetts children with current asthma reported experiencing symptoms of asthma at least once in the past 30 days.
- 76.0% of children with current asthma were symptom free for more than ten days in the past 2 weeks.
- 44.2% of children with current asthma experienced at least one asthma attack or episode in the past 12 months.
- Massachusetts children with current asthma missed an average of 2.0 days of school or daycare because of their asthma in the past 12 months.

- 37.8% of children with current asthma missed school or daycare because of their asthma at least once during the past 12 months.

Table 2.8: Prevalence of Asthma Self-Management Education among Children with Current Asthma, 2006-2007
Massachusetts Respondents Ages 0-17 Years

	Massachusetts			US	
Asthma Self-Management Education	**Sample Size[1]**	**%[2]**	**95% CI[3]**	**%**	**95% CI**
Taken a class on asthma management,[4] HP2010	112	7.8*	2.2-13.3	16.1	13.8-18.8
Received an asthma action plan,[5] HP2010	112	45.0	31.9-58.0	39.5	36.1-43.0
Taught to use a peak flow meter,[6] HP2010	111	55.3	41.9-68.8	56.8	52.8-60.7
Taught to recognize early signs of an asthma attack,[7] HP2010	113	84.2	74.9-93.5	72.4	36.0-75.6
Taught to respond to an asthma attack,[8] HP2010	113	89.3	82.7-95.8	77.5	74.3-80.4
Taught how to use a prescribed inhaler,[9] HP2010	92	97.2	93.3-100.0	NA	NA
Advised to change aspects of the home, school or work[10]	110	49.6	36.5-62.7	53.1	49.6-56.5

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to "Have you [or child] ever taken a course or class on how to manage your asthma?"
[5] "Yes" to "Has a doctor or other health professional ever given you [or child] an asthma action plan?"
[6] "Yes" to "Has a doctor or other health professional ever taught you [or child] how to use a peak flow meter to adjust your daily medications?"
[7] "Yes" to "Has a doctor or other health professional ever taught you [or child] how to recognize early signs or symptoms of an asthma episode?
[8] "Yes" to "Has a doctor or other health professional ever taught you [or child] what to do during an asthma attack or episode?"
[9] "Yes" to "Did a doctor or other health professional show [child] how to use the inhaler?" or "Did a doctor or health professional watch [child] use the inhaler?"
[10] 'Yes" to "Has a health professional ever advised you to change things in [child's] home, school, or work to improve his/her asthma?"
NA = Data not available.
* Relative Standard Error is > 30% therefore the results should be interpreted with caution due to the instability of the estimate.
Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health. US Data: 2003 National Health Interview Survey, National Center for Health Statistics

- From 2006 through 2007, the two-year average annual prevalence of asthma self-management education varied by educational components among children with current asthma in Massachusetts.
- The prevalence of asthma self-management education among Massachusetts children with current asthma was similar to the national average for each educational component.[28]

Table 2.9: Prevalence of Proactive Health Care Utilization among Children with Current Asthma, 2006-2007
Massachusetts Respondents Ages 0-17 Years

Proactive Health Care Utilization	Sample Size[1]	%[2]	95% CI[3]
Had routine checkup for asthma, past 12 months[4]	111		
0 checkups		20.0	10.8-29.2
≥1 checkup		80.0	70.8-89.2
Received flu vaccine, past 12 months[5]	113	48.9	35.5-62.2

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "During the past 12 months, how many times as [child] see a doctor or other health professional for a routine checkup for his/her asthma?"
[5] "Yes" to "During the past 12 months, has [child] had a flu shot?" or "During the past 12 months, has [child] had a flu vaccine that was sprayed in his/her nose?"

- Approximately half of the Massachusetts children with current asthma received a flu vaccination in the past 12 months.

Table 2.10: Prevalence of Medication Use among Children with Current Asthma, 2006-2007

Massachusetts Respondents Ages 0-17 Years

Medication Use	Sample Size[1]	%[2]	95% CI[3]
Used any prescription asthma medication, past 3 months[4]	113	66.4	53.7-79.2
Used inhaled corticosteroid, past 3 months[5]	113	29.7	17.2-42.1
Used inhaled long-acting beta2-agonist, past 3 months[6]	113	2.4*	0.0-4.8
Used leukotriene modifier, past 3 months[7]	113	12.9*	4.9-20.9
Used inhaled anti-inflammatory, past 3 months[8]	113	0.0	--
Used inhaled short-acting beta2-agonists, past 3 months[9]	113	45.5	32.4-58.5
Used any inhaled prescription asthma medication, past 3 months[10]	111	56.1	43.3-68.9
Used a spacer (with inhaled prescription asthma medication)[11]	63	62.1	43.5-80.7

[1] Sample size is the number of respondents who answered the corresponding questions(s).
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
[4] "Yes" to "In the past 3 months, _____" to any of the following:
Has [child] taken prescription asthma medicine using an inhaler?"
Has [child] taken prescription asthma medication in pill form?"
Has [child] taken prescription asthma medication in syrup form?"
Were any of [child's] asthma medicines used with a nebulizer?"
[5] "One or more" inhaled corticosteroid in the past 3 months
[6] "One or more" inhaled long-acting beta2-agonists in the past 3 months
[7] "One or more" leukotriene modifier in the past 3 months
[8] "One or more" inhaled anti-inflammatory in the past 3 months
[9] "One or more" inhaled short-acting beta2-agonists in the past 3 months
[10] "One or more" inhaled prescription asthma medications in the past 3 months
[11] "Yes" to "Does [child] use a spacer with [list of medications taken with an inhaler]?"
* Relative Standard Error >30% and therefore should be interpreted with caution due to the instability of the estimate.
Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health

- Of those using an inhaled prescription asthma medication, 62.1% reported using a spacer.

Table 2.11: Prevalence of Environmental Triggers and Modifications in the Home among Children with Current Asthma, 2006-2007
Massachusetts Respondents Ages 0-17 Years

Environmental Triggers in the Home	Sample Size[1]	%[2]	95% CI[3]
Carpeting or rugs in bedroom[4]	111	56.3	43.0-69.6
Gas used for cooking[5]	111	51.5	38.5-64.5
Has pets inside home[6]	111	49.6	36.5-62.7
Wood burning fireplace/stove[7]	111	27.2	14.8-39.5
Pets allowed in bedroom[8]	113	26.6	14.4-38.8
Mice or rats inside the home, past 30 days[9]	111	11.0	4.7-17.3
Mold inside the home, past 30 days[10]	111	8.7*	2.6-14.8
Gas fireplace or unvented gas stove[11]	110	4.9*	0.0-9.7
Smoking inside the home, past week[12]	111	3.5**	0.0-7.0
Cockroaches inside the home, past 30 days[13]	111	1.4**	0.0-2.9
Modifications			
Exhaust fan used in the bathroom[14]	110	59.3	45.9-72.6
Exhaust fan used in the kitchen[15]	111	52.8	39.5-66.1
Sheets and pillowcases washed in hot water[16]	109	52.0	38.6-65.4
Mattress cover used[17]	110	41.8	28.9-54.8
Pillow cover used[18]	110	37.6	24.7-50.5
Dehumidifier regularly used[19]	111	35.3	23.1-47.5
Air cleaner or purifier regularly used[20]	111	33.3	20.3-46.3

[1]Sample size is the number of respondents who answered the corresponding questions(s).
[2]Percents are weighted to population characteristics.
[3]95% Confidence Interval.
[4] "Yes" to "Do you have carpeting or rugs in [child's] bedroom?"
[5] "Yes" to "Is gas used for cooking?"
[6] "Yes" to Does [child's] household have pets such as dogs, cats, hamsters, birds or other feathered or furry pets that spend time indoors?
[7] "Yes" to "Is a wood burning fireplace or wood burning stove used in [child's] home?"
[8] "Yes" to " Are pets allowed in [child's] bedroom?"
[9] "Yes" to "In the past 30 days, has anyone seen mice or rats inside [child's] home?"
[10] "Yes" to "In the past 30 days, has anyone seen or smelled mold or a musty odor inside [child's] home?"
[11] "Yes" to "Are unvented gas logs, unvented gas fireplaces, or unvented gas stoves used in your home?"
[12] "Yes" to "In the past week, has anyone smoked inside [child's] home?"
[13] "Yes" to "In the past 30 days, has anyone seen a cockroach inside your home?"
[14] "Yes" to "In [child's] bathroom, does [child] regularly use an exhaust fan that vents to the outside?"
[15] "Yes" to "Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?"
[16] "Hot" to "Are your sheets and pillowcases washed in cold, warm or hot water?"
[17] "Yes" to "Does [child] use a mattress cover that is made especially for controlling dust mites?"
[18] "Yes" to "Does [child] use a pillow cover that is made especially for controlling dust mites?"
[19] "Yes" to "Is a dehumidifier regularly used to reduce moisture inside your home?"
[20] "Yes" to "Is an air cleaner or purifier regularly used inside your home?"
* Relative Standard Error is > 30% therefore the results should be interpreted with caution due to the instability of the estimate.
** Relative Standard Error is >50% therefore the results should be interpreted with caution due to the instability of the estimate.
Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health

- Among Massachusetts children with current asthma, the most commonly reported environmental exposures in the home were carpeting or rugs in the bedroom (56.3%) followed by gas used for cooking (51.5%) and pets inside the home (49.6%).
- Use of an exhaust fan in the bathroom (59.3%) and kitchen (52.8%) were reported most often as an environmental modifications followed by washing sheets in hot water (52.0%) among Massachusetts children with current asthma.

School-based Asthma Management: Essential School Health Services Program
The data collected by the Essential School Health Services Program at MDPH provides a valuable snapshot of school nursing practice in a diverse cohort of Massachusetts public schools for grades Kindergarten through 12th. The data examine the wide variety of duties performed by school nurses including direct care, health education, administrative case management and policy/program development. School nurses treat students whose health needs range from routine to serious and complex and even school staff. The MDPH Essential School Health Services grant funded 102 school districts in Massachusetts during the 2007-2008 school year (September – June). Additional details of this data are described in a previously published report.[29]

- During the 2007-08 school year, the majority (90.9%) of the prescriptions reported to the school nurse were medications dispensed on an "as needed" basis (a.k.a. PRN medication). Among the PRN prescriptions *reported* to the school nurse, asthma medications were the most common type (27.7%).
    - Among the PRN prescriptions *administered* by the school nurse, asthma medications were the most common type (52.6%).

- The at-school prescription medication rate reflects the medications that are to be administered at school during school hours by the school nurse. From the 2000-01 school year to the 2007-08 school year, the prescription medication rate for PRN asthma medications increased 32.5% from 25.2 to 33.4 per 1,000 students. The prescription medication rate of epinephrine increased 134.7% from 7.2 to 16.9 per 1,000 students
    - In contrast, during the same time period, the prescription medication rate for scheduled asthma medications decreased 66.7% from 1.5 to 0.5 per 1,000 students.

- Certain procedures performed by school nurses require significant amounts of professional nursing care, health education and monitoring, such as assessing the need for an urgent nebulizer treatment. During the 2007-08 school year, the medical procedure rate for a nebulizer treatment was 1.3 per 1,000 students per month. The medical procedure rate for peak flow monitoring was 1.2 per 1,000 students per month. On average, there were 1,119 nebulizer treatments and 2,047 peak flow monitoring procedures each month in the ESHS funded districts.

- During the 2007-08 school year, 96 ESHS funded districts reported receiving Asthma Action Plans for 4,446 students (8.1% of students known to have asthma). Individual districts reported receiving between 0 and 108 Asthma Action Plans.

- Of the ESHS funded districts during the 2007-08 school year, 16.7% offer asthma support group activities that are led or assisted by a school nurse. Overall, the ESHS asthma support groups attracted an average of 46.7 students, 9.5 staff, and 19.2 parents or community members each month.

- In the ESHS districts, the most common physical/developmental condition reported to the school nurse was asthma (105.8 per 1,000 students).

MassHealth Health Plan and Employer Data and Information Set (HEDIS)
HEDIS is a set of performance measures used by more than 90% of America's health plans for assessing, reporting, and improving the quality of care. Five health plans serve the MassHealth managed care population (Boston Medical Center HealthNet Plan, Fallon Community Health Plan, Neighborhood Health Plan, Network Health and the Primary Care Clinician Plan). Managed care plan members who are 5 to 56 years and were continuously enrolled in a Medicaid managed care plan in 2008 were included in the analysis. According to the National Heart, Lung, and Blood Institute's (NHLBI) *Guidelines for the Diagnosis and Management of Asthma*, people with persistent asthma should use daily long-term control medication for their asthma.[11] The *MassHealth Managed Care HEDIS 2008 Final Report* presents data on the percent of Massachusetts Medicaid enrollees with persistent asthma who have filled at least one prescription for a long-term asthma control medication in the past year (i.e. "use of appropriate medications").[27] The 2008 national Medicaid 75th percentile represents a level of performance that was exceeded by only the top 25% of all Medicaid plans that submitted HEDIS 2008 data. The 2008 MassHealth weighted mean is the weighted average of the rates of the 5 MassHealth plans.

Table 2.12: Percentage of Medicaid Members with Persistent Asthma who Filled Asthma Control Medication Prescription by Insurer, 2008
Massachusetts Medicaid Members

HEDIS 2008 Measure	2008 National Medicaid 75th Percentile Benchmark %	MassHealth Weighted Mean %	PCCP %	NHP %	NH %	FCHP %	BMCHP %
Use of Appropriate Medications for People with Asthma (5-56 Years)	90.7	87.2	84.5↓	90.8	89.4	80.2↓	90.5
Ages 5-9 Years	94.5	94.4	94.5	94.4	92.8	NA	95.9
Ages 10-17 Years	91.4	90.8	88.6↓	93.0	90.7	NA	92.8
Ages 18-56 Years	88.7	82.9	81.1↓	86.0↓	86.3↓	77.6↓	86.2↓

↓ indicates a rate that is significantly below the 2006 national Medicaid 75th percentile benchmark.
NA is Not Available.
Key: PCCP – Primary Care Clinical Plan, NHP – Neighborhood Health Plan, NH – Network Health, FCHP – Fallon Community Health Plan, BMCHP – Boston Medical Center HealthNet Plan
Data Source: 2008 MassHealth Managed Care Health Plan and Employer Data and Information Set (HEDIS) Final Report

- 87.2% of MassHealth members 5-56 years of age with persistent asthma met the 2006 HEDIS definition for use of appropriate long-term control medications.
    - This means, 12.8% of MassHealth member with persistent asthma did not fill any prescription for a long-term control medication in the past year.
- In Massachusetts, there were no plans that performed significantly better than the 2008 national Medicaid 75th percentile for any of the measure's age stratified rates or the combined rate.
- One plan (NHP) had a 2008 rate (90.8%) that was significantly better than its 2006 (87.6%) rate for the combined age group (5 to 56 years).

Section 3. Work-related Asthma

Work-related asthma (WRA) is defined as asthma that is caused or made worse by the work environment. Some substances in the workplace, such as isocyanates, latex and formaldehyde, can cause asthma in people who never had asthma previously. Substances in the workplace can also trigger asthma attacks in people with pre-existing asthma.[8] (Over 350 substances have been associated with WRA.[30])

Massachusetts has two data sources that are used to track WRA: the Massachusetts Sentinel Event Notification System for Occupational Risk (SENSOR) and the Massachusetts Behavioral Risk Factor Surveillance System (BRFSS). The SENSOR asthma project uses health care providers' reports, hospital records, and worker's compensation files to identify cases of WRA and conducts case follow-up activities. This is a sentinel case surveillance system that identifies exposures associated with WRA and workplaces where intervention is needed. However, the findings are not necessarily representative of the underlying incidence of WRA in the state. The Massachusetts BRFSS provides self-reported population-based data on WRA. In 2001, 2002, and 2005, several questions on physician diagnosed WRA were included. Starting in 2006, a more extensive list of questions on WRA has been included in the BRFSS Adult Asthma Call-back Survey (ACS).

This section presents data from SENSOR on the distribution of work-related asthma cases by industry and occupation, and the most frequently reported exposures associated with WRA in Massachusetts.[31] It also includes data from Adult ACS on a respondents' self-assessment that his/her asthma is related to work.[32] In this analysis, asthma is considered work-related if the individual responded that his or her asthma was caused or made worse by exposures to chemicals, smoke, fumes or dust in either a current or previous job. Additional details about these data sources and methodology used for analysis are available in Appendix A.

Table 3.1: Distribution of Work-related Asthma Cases by Industry in Massachusetts, 1993-2006

Industry	No.[1]	%[2]
Services	**334**	**52.8**
Health Care	181	28.6
Hospital	139	22.0
Educational Services	83	13.1
Elementary and Secondary	66	10.4
All Other	70	11.1
Manufacturing	**150**	**23.7**
Chemicals and allied products	23	3.6
Miscellaneous mfr	17	2.7
Electrical machinery	15	2.4
Machinery, excl electrical	14	2.2
Fabricated metal products	13	2.1
Food and kindred products	13	2.1
Measuring devices	12	1.9
All other	43	6.8
Public Administration	**56**	**8.8**
Justice, public order, safety	23	3.6
Regulation of transportation	14	2.2
All other	19	3.0
Trade (wholesale/retail)	**42**	**6.6**
Construction	**22**	**3.5**
Construction, special trades	14	2.2
All other	8	1.3
Transportation	**16**	**2.5**
Other	**13**	**2.1**

[1]No. is the number of individuals captured in SENSOR.
[2]Percents of the total individuals captured in SENSOR.
Note: Industry codes are coded according to the Standard Industrial Classification System (1987).
Data Source: 1993-2006 Sentinel Event Notification System for Occupational Risk, Massachusetts Department of Public Health

- Over half of all the WRA cases were employed in the service sector (n=334, 52.8%), mostly in the health care industry (n=181, 28.6%), followed by educational services (n=83, 13.1%).
- Manufacturing accounted for one quarter of all cases (n=150, 23.7%) with cases distributed among many different industries.

Table 3.2: Distribution of Work-related Asthma Cases by Occupation in Massachusetts, 1993-2006

Occupation	No.[1]	%[2]
Managerial and Professional	**206**	**32.6**
Nurses	84	13.3
Teachers	54	8.6
Managers	26	4.1
Engineers/scientists	10	1.6
All Other	32	5.1
Operators/Repair/Laborers	**171**	**27.1**
Construction/painters	21	3.3
Mechanics/repairers	20	3.2
Assemblers	13	2.1
Spray painting	12	1.9
Plastic/metal machine operators	12	1.9
Welders	12	1.9
Textile/apparel	10	1.6
All other	71	11.3
Technical, Sales, Administrative	**145**	**23.0**
Administration/office workers	83	13.2
Health technicians	47	7.4
Sales	15	2.4
Service	**80**	**12.7**
Cleaning occupations	22	3.5
Health aides	21	3.3
Protective services (police/fire)	17	2.7
Food preparation	10	1.6
All other	10	1.6
Transportation	**21**	**3.3**
Farming, Forestry, Fishing	**7**	**1.1**

[1]No. is the number of individuals captured in SENSOR.
[2]Percents of the total individuals captured in SENSOR.
Note: Occupational codes are coded according to the Census Occupation Code. Occupation codes are missing for two (2) cases.
Data Source: 1993-2006 Sentinel Event Notification System for Occupational Risk, Massachusetts Department of Public Health

- Managerial and professional workers accounted for one-third of all cases (n=206, 32.6%), with nurses and teachers as the most frequently reported occupations within this group.
- Operators, repair workers and laborers accounted for 27.1% of cases (n=171).
- Technical, sales and administrative workers accounted for 23.0% (n=145), with office workers and health technicians as the most frequently reported occupations in this category.

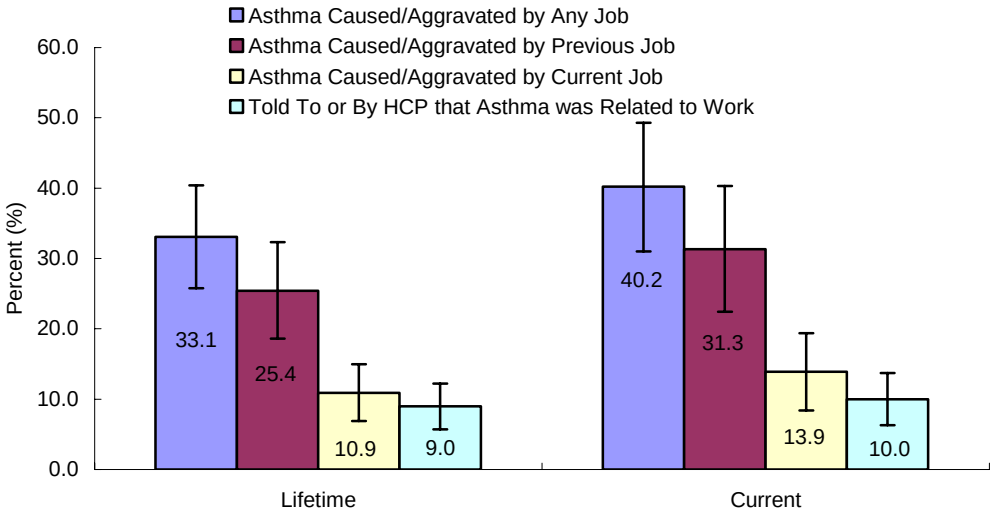
Table 3.3: Fifteen Most Frequently Reported Exposures Associated with Asthma among Work-related Asthma Cases in Massachusetts, 1993-2006 (N=1,899 agents[1])

Agent[1]	No.[2]	%[3]
Indoor Air Pollutants[4]	156	8.2
Cleaning Products[5]	145	7.6
Minerals and Inorganic Dusts	142	7.5
Chemicals, Not Otherwise Specified	108	5.7
Mold	78	4.1
Solvents	73	3.8
Products of Combustion[6]	51	2.7
Latex	46	2.4
Isocyanates[7]	39	2.1
Paints and Lacquers	27	1.4
Acids and Bases	25	1.3
Metals	23	1.2
Formaldehyde	21	1.1
Polymers	20	1.1
Welding Fumes	19	1.0

[1] At least one agent was reported for each case; a maximum of three agents could be reported.
[2] No. is the number of exposures reported by individuals captured in SENSOR.
[3] Percents of the total number of exposures captured in SENSOR.
[4] Includes cases who report "bad air", "indoor air pollutants", "poor ventilation" or "sick building syndrome". More specific agents associated with indoor air pollution, including dust and mold, are coded separately.
[5] Includes specific cleaning products such as bleach and ammonia.
[6] Includes smoke and exhaust.
[7] Includes MDI, TDI, and HDI, etc.
Data Source: 1993-2006 Sentinel Event Notification System for Occupational Risk, Massachusetts Department of Public Health

- The most frequently reported exposures included indoor air pollutants (8.2%), cleaning products (7.6%), dusts and fibers (7.5%), chemicals, not otherwise specified (5.7%), mold (4.1%), and solvents (3.8%).
- The most frequently reported known asthma-causing agents, according to the Association of Occupational and Environmental Clinics, were latex, isocyanates, formaldehyde, glutaraldehyde, metal working oils, quaternary ammonium compounds and baking flour.[30]

Figure 3.1: Proportion of Adults with Lifetime or Current Asthma Reporting That Their Asthma Was Associated with Work, 2006-2007
Massachusetts Respondents Ages 18+ Years

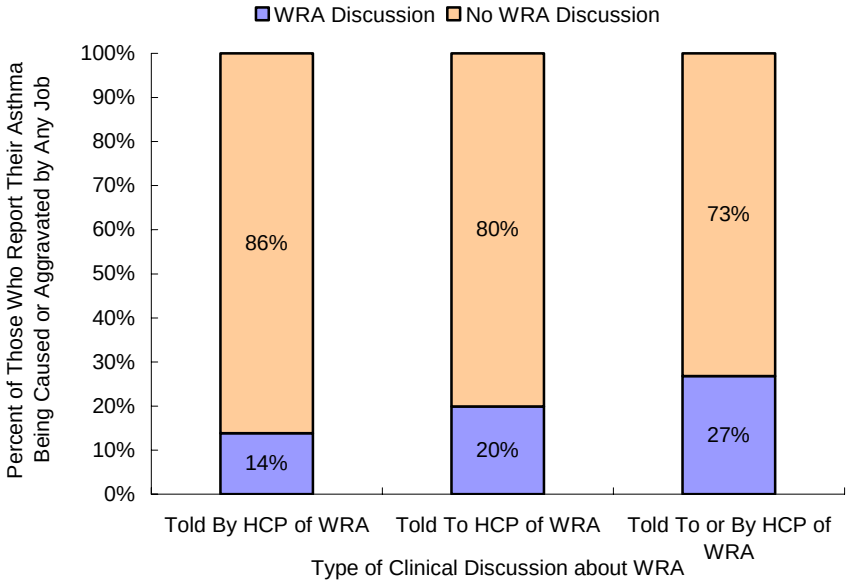


	Lifetime			Current		
	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
Asthma Caused/Aggravated by Any Job[4]	195	33.1	25.8-40.4	163	40.2	31.0-49.3
Asthma Caused/Aggravated by Previous Job[4]	153	25.4	18.6-32.3	128	31.3	22.4-40.3
Asthma Caused/Aggravated by Current Job[4]	61	10.9	6.9-15.0	54	13.9	8.4-19.4
Told To or By HCP that Asthma was Related to Work[4]	65	9.0	5.7-12.2	54	10.0	6.3-13.7

[1]Sample size is the number of respondents who answered the corresponding questions(s).
[2]Percents are weighted to population characteristics.
[3]95% Confidence Interval.
[4]Definition of variable is available in Appendix A.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health.

- Among adults with lifetime asthma, 33.1% reported that their asthma was either caused or made worse by exposures at either their current or previous job.
- Among those with current asthma, this proportion was 40.2%.
- 13.9% of adults with current asthma reported that their asthma was caused or made worse by exposures at their current job.
    - In previous reports of WRA based on the BRFSS, individuals with WRA were defined as those that had either been told by or told to their health care provider that their asthma was work-related. Only 10% of adults with current asthma reported ever telling or being told by a health professional that their asthma was related to work.[33]
- Additionally, 4.5% (95% C.I. 2.4-6.6) of those with lifetime asthma and 5.1% (95% C.I. 2.6-7.6) of those with current asthma reported changing or quitting jobs because of their work-related asthma (data not shown).

Figure 3.2: Proportion of Adults with Lifetime Asthma Who Discussed With a Health Care Professional that Their Asthma was Work-related, 2006-2007
Massachusetts Respondents Ages 18+ Years



Type of Clinical Discussion	WRA Discussion (%)[1]	No WRA Discussion (%)[1]
Told by health care provider of WRA[2]	14%	86%
Told to health care provider of WRA[2]	20%	80%
Told to or by health care provider of WRA[2]	27%	73%

[1]Percents are weighted to population characteristics.
[2]Definition of variable is available in Appendix A.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health.

- Of adults with lifetime asthma who reported that their asthma was caused or made worse by either their current or previous job, only 26.8% (95% C.I. 24.2-29.4) reported ever telling or being told by a health professional that their asthma is work-related.

Table 3.4: Prevalence of Asthma Symptoms and Indicators of Asthma Severity among Adults with Lifetime Asthma by Work-Relatedness, 2006-2007
Massachusetts Respondents Ages 18+ Years

	WRA[3]		Non-WRA	
	%[1]	95% CI[2]	%[1]	95% CI[2]
Had asthma symptoms, past 30 days	62.0	49.5-74.5	39.6	30.6-48.7
Sleep disturbed from asthma, past 30 days	19.3	10.7-27.8	13.8	7.7-19.9
Had ≥1 asthma attack, past 12 months	48.3	34.7-61.9	29.6	21.1-38.2
Asthma limited usual activities, past 12 months	53.1	39.4-66.8	38.3	29.0-47.6
Had ≥1 ED or other urgent care visit for asthma, past 12 months[3]	9.5	4.1-14.8	9.5	3.9-14.3
Used Rx asthma medications, past 3 months[3]	50.2	36.4-63.6	42.8	34.0-51.6

[1]Percents are weighted to population characteristics.
[2]95% Confidence Interval.
[3]Definition of variable is available in Appendix A.
Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Adults with WRA were more likely to report asthma symptoms in the past 30 days than adults with non-WRA.
- Individuals with WRA consistently tended toward greater severity; however, differences in other indicators of asthma severity, such as sleep disturbances and ED visits, were not statistically significant.

Section 4. Hospital Treatment Due to Asthma

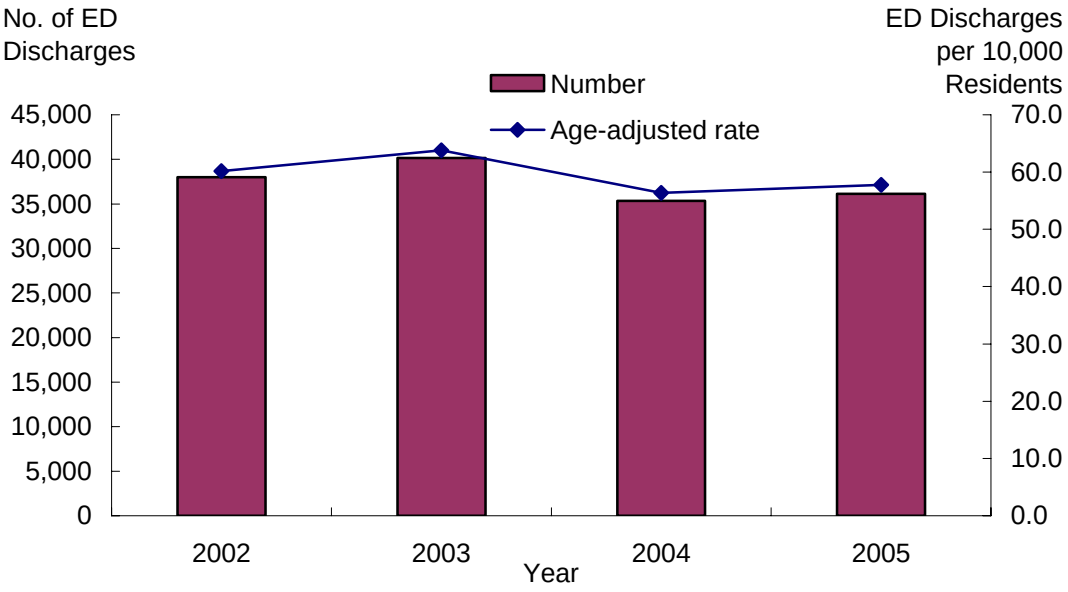
Increasing rates of hospital treatment due to asthma may indicate increasing prevalence or severity, or reflect progress in addressing the burden of asthma. Poor asthma outcomes such as hospitalizations are considered largely preventable with appropriate primary and ongoing asthma management, if patients and their families are adequately educated about the disease, and have access to high quality health care.[34] The US Department of Public Health Service identified reductions in emergency department visits and hospitalizations for asthma as national public health objectives.[35]

In this section, three statewide data sources are used to describe hospital treatment for asthma in Massachusetts: Emergency Department Discharge, Outpatient Observation Stay, and Inpatient Hospitalization Discharge Databases. (Observation stays are discharges from an observation bed of an acute care hospital. These are generally short term stays, although the criteria for an observation stay admission varies across hospitals.) Findings for each level of hospital care begin with a time trend using all years of data available. These data are followed by a more detailed examination of trends from the year 2000 (2002 for ED data) and forward to present the data most relevant for current public health planning purposes. Cross sectional findings are based on the most recent data available and in most instances, three years of data are aggregated to derive more stable estimates. Findings are compared to national estimates where possible. The section ends with a comparison of demographic characteristics of asthma patients across the three levels of hospital care.

For inpatient hospitalizations, an additional analysis was conducted to assess the rate of hospitalization among the Massachusetts population with current asthma, called at-risk based rates.[36] The at-risk based rates provide additional understanding of changes over time in hospitalizations during a period of increasing prevalence.

This section also includes data on hospital charges for each level of hospital care. In interpreting these findings on charges, readers should be aware of several data considerations. First, the charges for service are not reflective of the actual cost of care, nor are they reflective of what was reimbursed to the hospital by the payer. Second, some of the charges may be for diagnostic conditions unrelated to the asthma. Finally, the total direct charges do not include costs associated with the long-term effects of asthma, such as lost time from work and household duties or reduced quality of life. Additional details of data considerations of each data source are provided in Appendix A.

Figure 4.1: Number and Age-adjusted Rates of Emergency Department Visits due to Asthma, 2002-2005
Massachusetts Residents

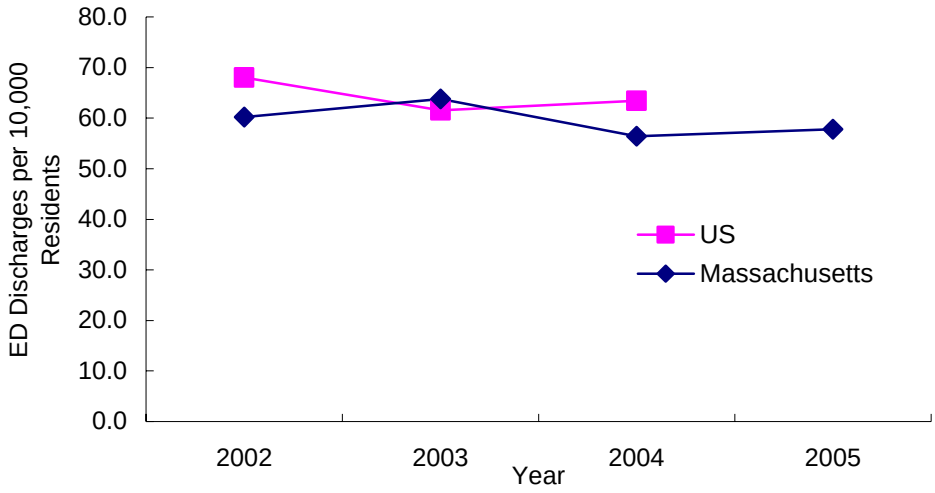


Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
2002	38,013	59.1	60.2	59.6-60.8
2003	40,155	62.4	63.8	63.2-64.5
2004	35,335	54.9	56.4	55.8-57.0
2005	36,146	56.1	57.8	57.2-58.4

[1]Rate of emergency department discharges due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- From 2002 through 2005, there were 149,649 emergency department visits due to asthma among Massachusetts residents. This means:
    - An average of 37,412 episodes of care due to asthma at an emergency department occurred every year, and
    - An average of 102 episodes of care due to asthma at an emergency department in Massachusetts occurred every day.
- During this time period, the Massachusetts age-adjusted rate remained stable.

Figure 4.2: Massachusetts and the US Age-adjusted Rates of Emergency Department Visits due to Asthma, 2002-2005
Massachusetts Residents and US Residents

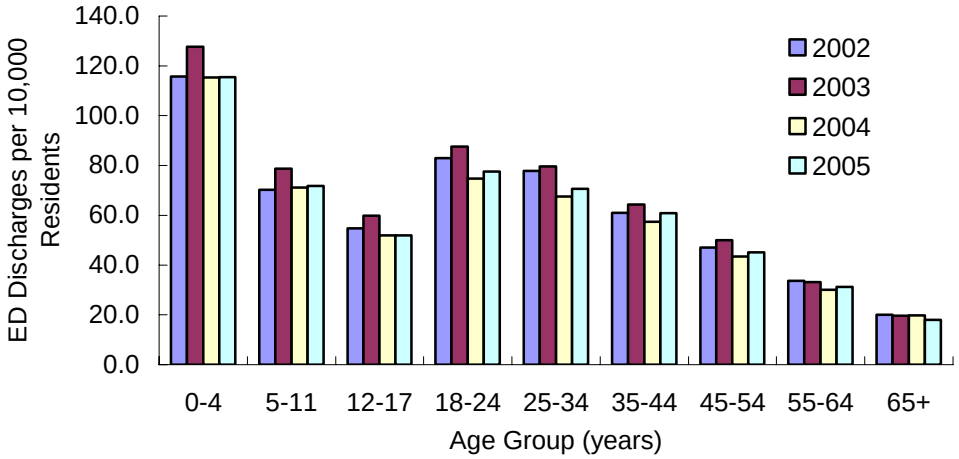


	Massachusetts				US
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI [3]	Age-adjusted rate[2]
2002	38,013	59.1	60.2	59.6 - 60.8	68.0
2003	40,155	62.4	63.8	63.2 - 64.5	61.5
2004	35,335	54.9	56.4	55.8 - 57.0	63.4
2005	36,146	56.1	57.8	57.2 - 58.4	NA

[1]Rate of emergency department discharge due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the Massachusetts age-adjusted rate.
NA = National data were not available (NA) for 2005 at the time this report was published.
Data Source: MA Data: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy; US Data: 2002-2004 National Ambulatory Medical Care Survey, National Center for Health Statistics.

- Compared to the US, Massachusetts had a lower age-adjusted rate of emergency department visits due to asthma in two of the three years for which both US and Massachusetts data are available.

Figure 4.3: Age-Specific Rates of Emergency Department Visits due to Asthma, 2002-2005
Massachusetts Residents



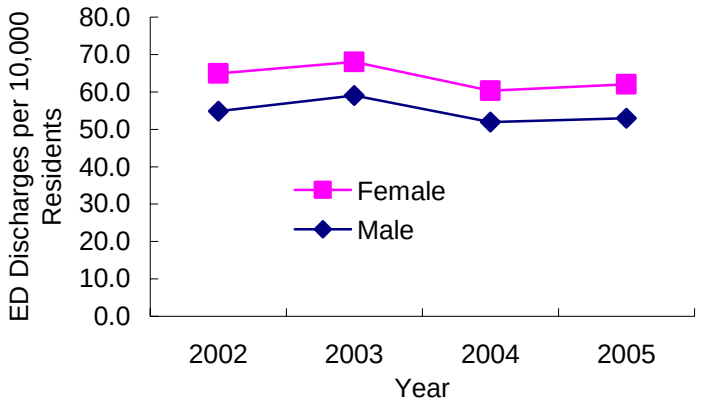
Age Group	0-4		5-11		12-17		18-24	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2002	4,589	115.8	4,136	70.3	2,820	54.7	4,987	83.0
2003	5,043	127.7	4,531	78.7	3,110	59.8	5,336	87.6
2004	4,541	115.4	4,017	71.2	2,694	51.9	4,633	74.8
2005	4,535	115.4	3,982	71.8	2,688	51.9	4,862	77.6

Age Group	25-34		35-44		45-54		55-64		65+	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2002	6,982	77.8	6,441	61.0	4,311	47.0	2,024	33.7	1,723	20.1
2003	7,006	79.6	6,703	64.3	4,652	50.0	2,087	33.2	1,687	19.7
2004	5,796	67.5	5,886	57.4	4,097	43.4	1,974	30.1	1,697	19.8
2005	5,935	70.7	6,146	60.8	4,330	45.1	2,122	31.2	1,540	18.0

[1]Rate of emergency department discharges due to asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- From 2002 through 2005, the Massachusetts age-specific rates of emergency department visits due to asthma were highest among children ages 0-4 years and decreased with each older childhood age group. There was a second peak in rates among young adults ages 18-24 years. The rates continued to decline with each older adult age group, and the lowest rates were among adults ages 65+ years.
- Within each age group, the age-specific rates remained stable from 2002 through 2005.

Figure 4.4: Age-adjusted Rates of Emergency Department Visits due to Asthma by Sex, 2002-2005
Massachusetts Residents

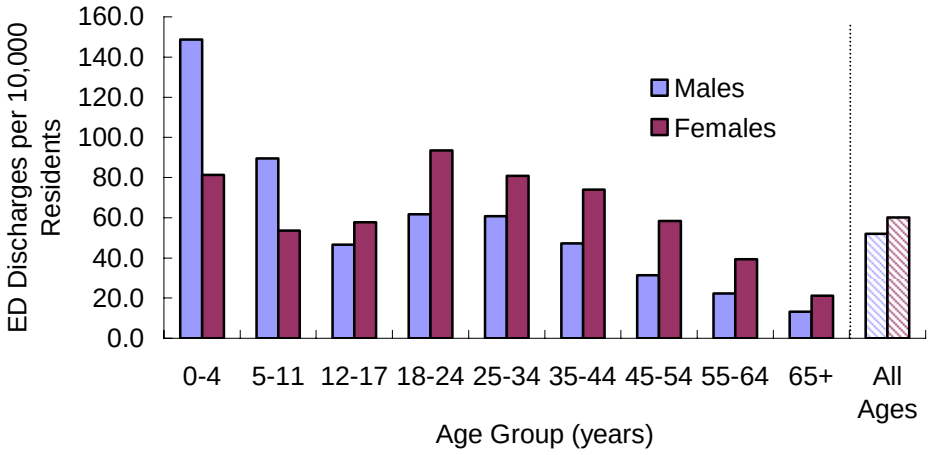


	Male				Female			
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
2002	16,985	54.7	54.9	54.0-55.7	21,027	63.2	64.9	64.0-65.8
2003	18,219	58.6	59.1	58.2-59.9	21,933	65.9	68.0	67.1-68.9
2004	15,942	51.2	52.0	51.2-52.8	19,393	58.4	60.3	59.4-61.1
2005	16,194	52.0	53.0	52.1-53.8	19,951	60.1	62.1	61.2-62.9

[1] Rate of emergency department discharges due to asthma per 10,000 residents.
[2] Age-adjusted to US 2000 Population.
[3] 95% Confidence Interval of the age-adjusted rate.
Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Health Care Finance and Policy

- During this time period, the age-adjusted rate for emergency department visits due to asthma was consistently higher among females than males.
- From 2002 through 2005, the age-adjusted rate remained stable for both males and females.

Figure 4.5: Age-Sex-Specific Rates of Emergency Department Visits due to Asthma, 2005
Massachusetts Residents

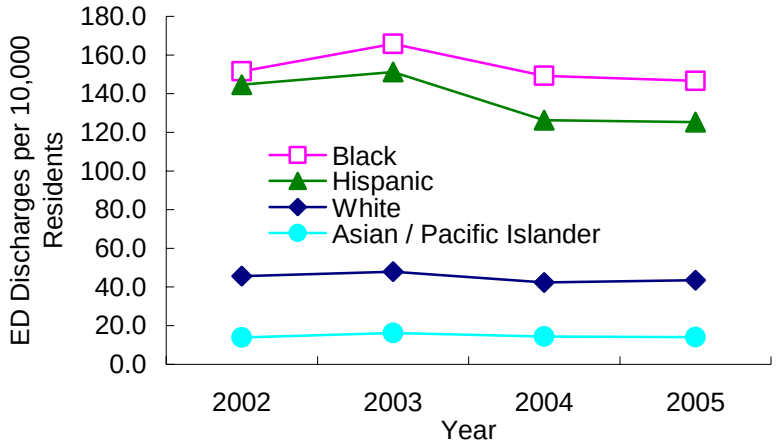


	Male		Female	
Age Group	**No.**	**Rate[1]**	**No.**	**Rate[1]**
0-4	2,977	148.7	1,557	81.3
5-11	2,534	89.6	1,448	53.6
12-17	1,236	46.6	1,458	57.7
18-24	1,922	61.7	2,940	93.6
25-34	2,536	60.7	3,399	80.8
35-44	2,346	47.2	3,800	74.0
45-54	1,460	31.3	2,870	58.3
55-64	724	22.3	1,398	39.4
65+	459	13.2	1,081	21.2
All Ages	16,194	52.0	19,951	60.1

[1]Rate of hospitalizations for asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- In 2005, the Massachusetts age-specific rates for emergency department visits due to asthma varied by sex, with the largest discrepancy in the 0-4 year age group.
- In the 0-4 and 5-11 age subgroups, males had higher rates compared to females. Starting in the 12-17 age subgroup, the age-specific rates were higher among females than males.

Figure 4.6: Age-adjusted Rates of Emergency Department Visits by Race/Ethnicity, 2002-2005
Massachusetts Residents

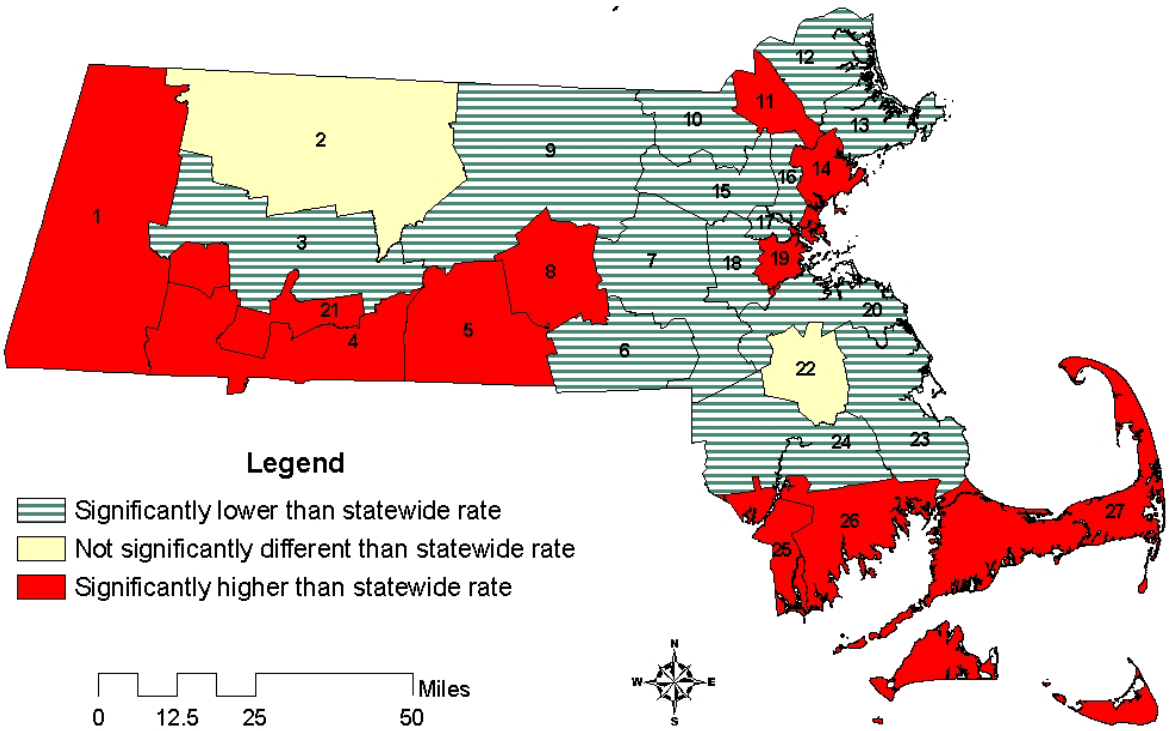


	Black			Hispanic		
Year	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]
2002	6,163	151.6	147.6 - 155.7	6,864	144.6	140.7 - 148.5
2003	6,700	165.8	161.8 - 169.9	7,404	151.3	147.4 - 155.2
2004	6,050	149.2	145.4 - 153.1	6,427	126.2	122.8 - 130.0
2005	6,033	146.7	143.0 - 150.4	6,544	125.3	122.0 - 128.5
	White			Asian/Pacific Islander		
Year	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]
2002	23,061	45.7	45.1 - 46.2	398	13.8	12.4 - 15.3
2003	23,938	47.9	47.3 - 48.5	476	16.2	14.6 - 17.7
2004	20,971	42.2	41.7 - 42.8	424	14.4	12.9 - 15.8
2005	21,472	43.4	42.9 - 44.0	427	14.1	12.7 - 15.5

[1] Rate of emergency department discharges due to asthma per 10,000 residents. Age-adjusted to US 2000 Population.
[2]95% Confidence Interval of the age-adjusted rate.
Note: Data excludes 130 cases of American Indian, non-Hispanic race.
Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- From 2002 through 2005, Blacks and Hispanics consistently had substantially higher age-adjusted rates of emergency department visits due to asthma than Whites. For each year examined, the highest rates were among Blacks.
- During this time period, Asian/Pacific Islanders consistently had lower age-adjusted rates than Whites.
- In 2005, relative to the rate among Whites, the rate of emergency department visits due to asthma among Blacks was 3.4 times higher and among Hispanics was 2.9 times higher.
- Within each race/ethnicity category, the age-adjusted rates remained relatively stable for Blacks and Whites from 2002 through 2005.
    - Among Hispanics, the rate during this time period decreased 13.4% from 144.6 to 125.2 per 10,000; however this trend was not statistically significant (ρ=-0.800, p=0.200).

Map 4.1: Three-year Average Annual Age-adjusted Rate of Emergency Department Visits due to Asthma by Community Health Network Area (CHNA) of Residence, 2003-2005
Massachusetts Residents



Data Source: CY2003-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- The three-year average annual age-adjusted rate of emergency department visits due to asthma among the 27 Community Health Network Area's (CHNA) were not evenly distributed across the state. Reasons for these differences by geography are unclear, but may be related to regional differences such as in the delivery of care for asthma episodes (e.g. more or less hospital-based care), access to health care services, or the local environment.
- The overall Massachusetts three-year average annual age-adjusted rate was 59.3 per 10,000 residents; rates in 14 CHNA's were lower and in 11 CHNA's were higher than the statewide rate.
- Among the 27 CHNA's, the three-year average annual age-adjusted rate was highest in CHNA 25: Partners for Healthier Communities (116.9 per 10,000) and lowest in CHNA 15: Northwest Suburban Health Alliance (25.7 per 10,000).
- The three-year average annual age-adjusted rate in 11 CHNA's was higher than the statewide rate (see table on next page).

Map 4.1 (continued): Three-year Average Annual Age-adjusted Rates of Emergency Department Visits due to Asthma by Community Health Network Area (CHNA) of Residence, 2003-2005

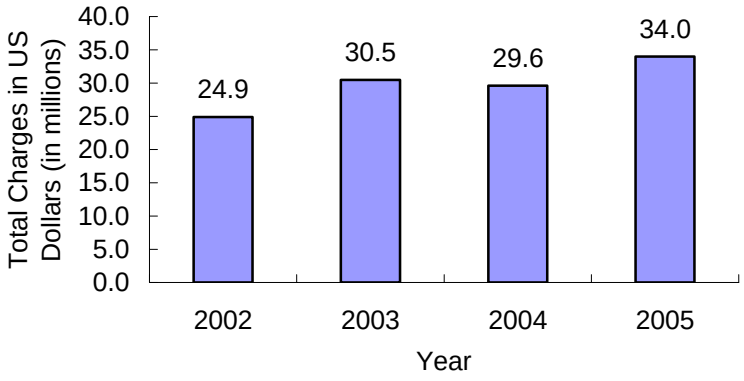
Massachusetts Residents

Community Health Network Area (CHNA)	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1. Community Health Network of Berkshire	2,885	72.6	79.0	76.1 - 82.0
2. Upper Valley Health Web (Franklin County)	1,507	56.9	61.1	57.9 - 64.2
3. Partnership for Health in Hampshire County (Northampton)	1,572	34.5	37.7	35.7 - 39.6
4. The Community Health Connection (Springfield)	8,307	92.7	95.3	93.2 - 97.3
5. Community Health Network of Southern Worcester County	2,647	74.4	78.1	75.1 - 81.1
6. Community Partners for Health (Milford)	1,769	37.1	38.0	36.2 - 39.9
7. Community Health Network of Greater Metro West (Framingham)	5,070	44.5	46.6	45.3 - 47.9
8. Common Pathways (Worcester)	5,580	61.6	63.2	61.6 - 64.9
9. Community Health Network of Central Massachusetts	4,177	53.6	54.8	53.1 - 56.5
10. Greater Lowell Community Health Network	4,077	49.9	49.9	48.4 - 51.5
11. Greater Lawrence Community Health Network	4,044	69.6	69.1	67.0 - 71.2
12. Greater Haverhill Community Health Network	1,988	44.7	47.0	45.0 - 49.1
13. Greater Beverly/ Gloucester Community Health Network	1,266	35.2	38.1	36.0 - 40.3
14. North Shore Community Health Network	5,101	59.4	62.2	60.4 - 63.9
15. Northwest Suburban Health Alliance	1,462	23.2	25.7	24.3 - 27.0
16. North Suburban Health Alliance (Medford/Malden/Melrose)	2,956	38.2	40.4	38.9 - 41.9
17. Greater Cambridge/Somerville Community Health Network	3,084	37.3	41.1	39.5 - 42.6
18. West Suburban Health Network (Newton/Waltham)	1,855	24.4	26.3	25.1 - 27.6
19. Alliance for Community Health (Boston/Chelsea/Revere/Winthrop)	19,490	90.0	94.0	92.7 - 95.4
20. Blue Hills Community Health Alliance (Quincy)	4,398	39.5	42.9	41.6 - 44.2
21. Community Health Network of Chicopee-Holyoke-Ludlow-Westfield	3,628	74.9	78.6	76.1 - 81.2
22. Greater Brockton Community Health Network	4,346	60.0	60.3	58.5 - 62.1
23. South Shore Community Health Network	2,492	44.3	46.5	44.6 - 48.3
24. Greater Attleboro-Taunton Health Education	3,742	49.4	49.8	48.2 - 51.4
25. Partners for Healthier Communities (Fall River)	4,750	111.3	116.9	113.5 - 120.2
26. Greater New Bedford Community Health Network	3,903	65.1	68.1	66.0 - 70.2
27. Cape Cod and Islands Community Health Network	5,493	72.3	81.2	79.0 - 83.3
Massachusetts Total	111,592	57.8	59.3	59.0 - 59.7

[1] Three-year average annual crude rate of emergency department discharges due to asthma per 10,000 residents.
[2] Age-adjusted to US 2000 Population.
[3] 95% Confidence Interval of the age-adjusted rate.
Note: Highlighted rows indicate CHNA's with a three-year average annual age-adjusted rate that was higher than the statewide rate.
Data Source: CY2003-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

Figure 4.7: Total Charges for Emergency Department Visits due to Asthma, 2002-2005

Massachusetts Residents



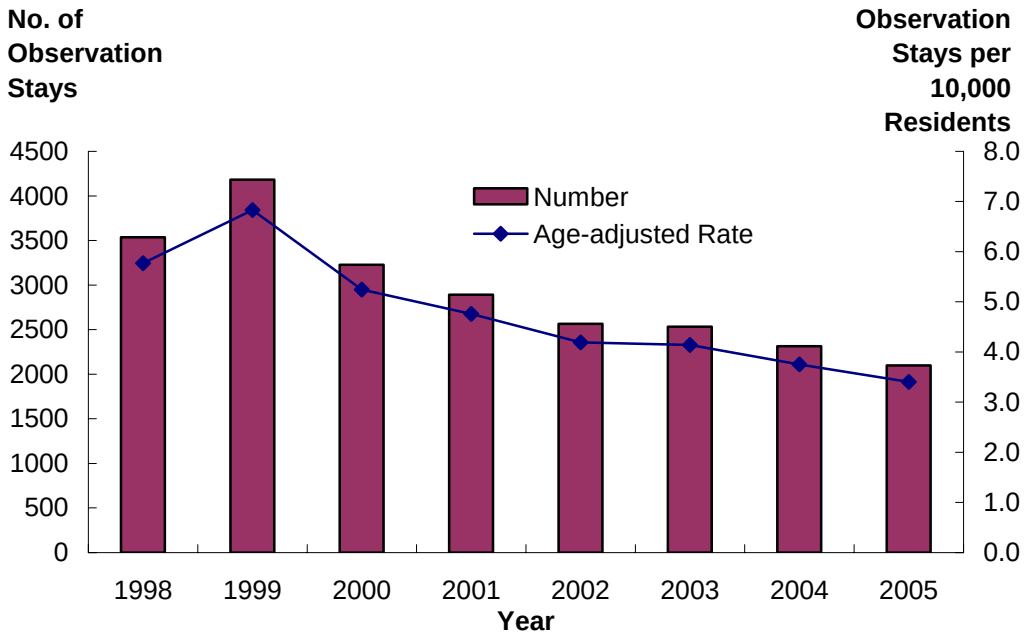
Year	Total Charges	Mean Charge	Median Charge
2002	$24,919,637	$656	$555
2003	$30,494,389	$760	$659
2004	$29,557,732	$837	$724
2005	$34,035,029	$942	$828

Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

- For emergency department discharges due to asthma from 2002 through 2005, the combined total charges were over $119 million. This was an average of $29.8 million per year.
- During this time period, the total charges increased 36.6% from $24.9 million in 2002 to $34.0 million in 2005 (unadjusted for inflation); however this increase was not statistically significant (ρ=0.800, p=0.200).
    - Mean charges per visit increased 43.6% from $656 to $942 ($\rho$=1.000, p<0.0001).
    - Median charges per visit increased 49.2% from $555 to $828 ($\rho$=1.000, p<0.0001).

Figure 4.8: Number and Age-adjusted Rates of Observation Stays due to Asthma, 1998-2005

Massachusetts Residents

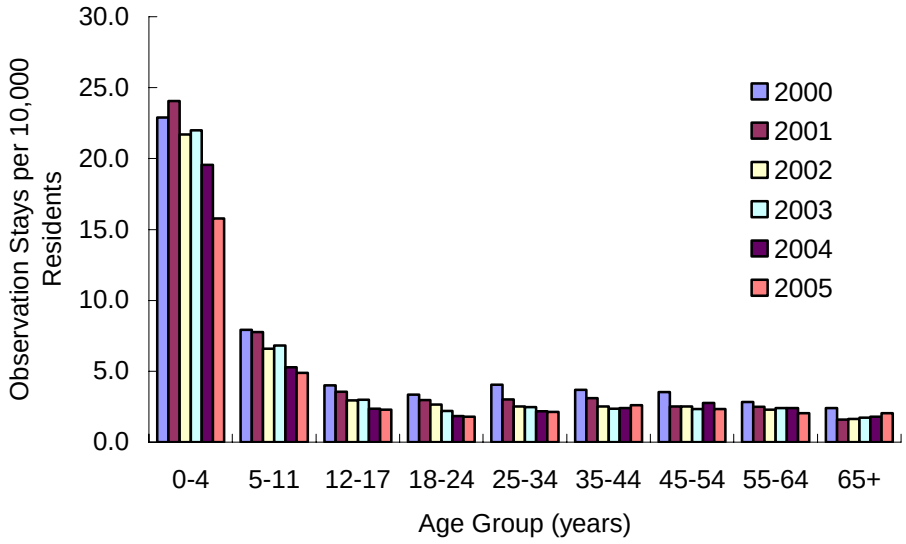


Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1998	3,535	5.6	5.8	5.6-6.0
1999	4,180	6.6	6.8	6.6-7.0
2000	3,227	5.1	5.2	5.1-5.4
2001	2,893	4.5	4.8	4.6-4.9
2002	2,564	4.0	4.2	4.0-4.4
2003	2,534	3.9	4.1	4.0-4.3
2004	2,315	3.6	3.8	3.6-3.9
2005	2,101	3.3	3.4	3.3-3.5

[1]Rate of observation stays due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY1998-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

- From 1998 through 2005, there were 23,349 observation stays due to asthma among Massachusetts residents. This means:
    - An average of 2,919 observation stays due to asthma occurred every year, and
    - An average of 8 observation stays due to asthma occurred every day.
- During this time period, the Massachusetts age-adjusted rate of observation stays due to asthma decreased 42.1% from 5.8 to 3.4 per 10,000 residents (ρ=0.976, p<0.0001).

Figure 4.9: Age-specific Rates of Observation Stays due to Asthma, 2000-2005
Massachusetts Residents



Age Group	0-4		5-11		12-17		18-24	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2000	909	22.9	482	7.9	199	4.0	195	3.3
2001	955	24.1	468	7.8	179	3.5	176	3.0
2002	860	21.7	388	6.6	152	2.9	160	2.7
2003	869	22.0	392	6.8	156	3.0	135	2.2
2004	770	19.6	298	5.3	123	2.4	114	1.8
2005	618	15.8	270	4.9	119	2.3	112	1.8

Age Group	25-34		35-44		45-54		55-64		65+	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2000	375	4.1	393	3.7	311	3.5	156	2.8	207	2.4
2001	276	3.0	331	3.1	229	2.5	141	2.5	138	1.6
2002	227	2.5	267	2.5	231	2.5	138	2.3	141	1.6
2003	218	2.5	246	2.4	218	2.3	152	2.4	148	1.7
2004	188	2.2	247	2.4	262	2.8	158	2.4	155	1.8
2005	179	2.1	264	2.6	225	2.3	139	2.0	175	2.0

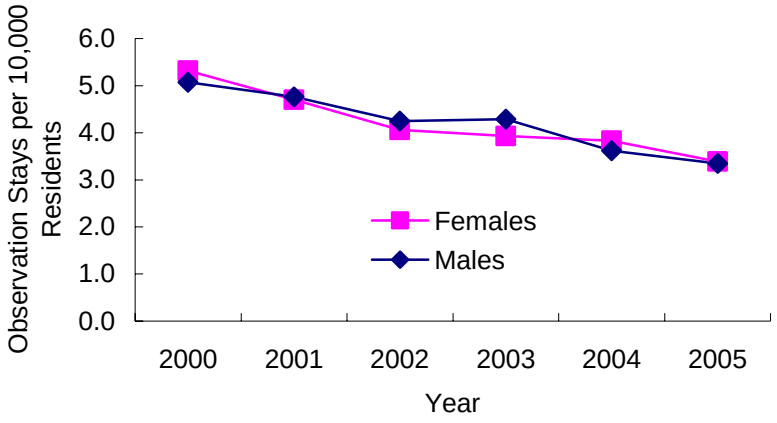
[1]Rate of observation stays due to asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2000-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

- From 2000 through 2005, the Massachusetts age-specific rates of observation stays due to asthma were highest among children ages 0-4 years. The rates decreased with increasing age group.
- Within each of the following age groups, the rates decreased from 2000 through 2005:
    - 0-4 years (31.0%; ρ=-0.886, p=0.019)
    - 5-11 years (38.0%; ρ=-0.943, p=0.005)

- 12-17 years (42.5%; ρ=-0.943, p=0.005)
- 18-24 years (45.5%; ρ=-0.986, p=0.0003)
- 25-34 years (48.8%; ρ= -0.986, p=0.0003)
- 55-64 years (28.6%; ρ=-0.812, p=0.049)

Figure 4.10: Age-adjusted Rates of Observation Stays due to Asthma by Sex, 2000-2005

Massachusetts Residents

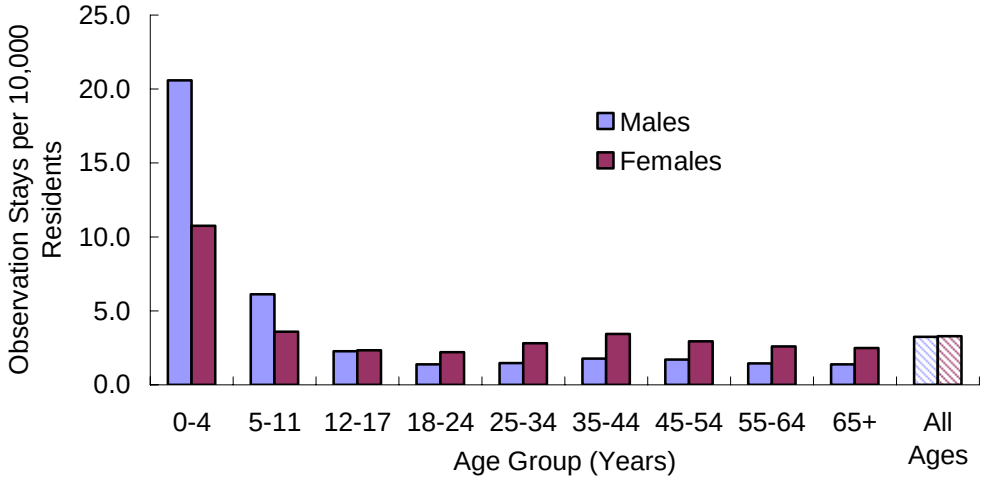


	Male				Female			
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
2000	1,532	5.0	5.1	4.8-5.3	1,695	5.1	5.3	5.1-5.6
2001	1,420	4.6	4.8	4.5-5.0	1,473	4.4	4.7	4.5-4.9
2002	1,277	4.1	4.3	4.0-4.5	1,287	3.9	4.1	3.8-4.3
2003	1,286	4.1	4.3	4.1-4.5	1,247	3.8	3.9	3.7-4.2
2004	1,092	3.5	3.6	3.4-3.8	1,223	3.7	3.8	3.6-4.0
2005	1,012	3.2	3.4	3.1-3.6	1,089	3.3	3.4	3.2-3.6

[1]Rate of observation stays due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY2000-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

- From 2000 through 2005, the age-adjusted rates of observation stays due to asthma decreased for both males and females:
    - Among males, rates decreased 33.9% from 5.1 to 3.4 per 10,000 residents (ρ=-0.943, p=0.0048)
    - Among females, rates decreased 36.2% from 5.3 to 3.4 per 10,000 residents (ρ=1.000, p<0.0001)
- During this time period, the age-adjusted rates were similar between males and females.

Figure 4.11: Age-Sex-Specific Rates of Observation Stays due to Asthma, 2005
Massachusetts Residents

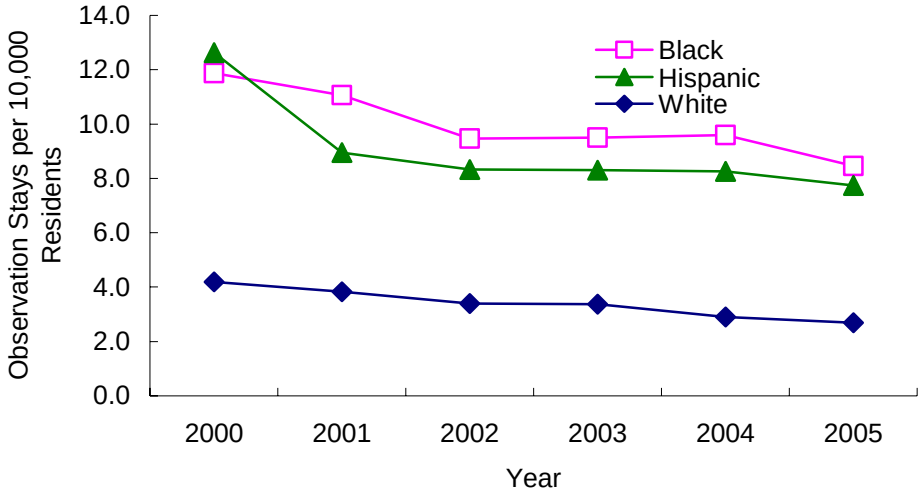


	Male		Female	
Age Group	**No.**	**Rate[1]**	**No.**	**Rate[1]**
0-4	412	20.6	206	10.8
5-11	173	6.1	97	3.6
12-17	60	2.3	59	2.3
18-24	43	1.4	69	2.2
25-34	61	1.5	118	2.8
35-44	88	1.8	176	3.4
45-54	80	1.7	145	2.9
55-64	47	1.4	92	2.6
65+	48	1.4	127	2.5
All ages	1,012	3.2	1,089	3.3

[1]Rate of observation stays due to asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy.

- In 2005, the age-specific rate of observations stays due to asthma varied by sex.
- In the 0-4 and 5-11 age subgroups, males had higher age-specific rates compared to females. Starting in the 18-24 age subgroup, the age-specific rates were higher among females than males.

Figure 4.12: Age-adjusted Rates of Observation Stays due to Asthma by Race/Ethnicity, 2000-2005
Massachusetts Residents

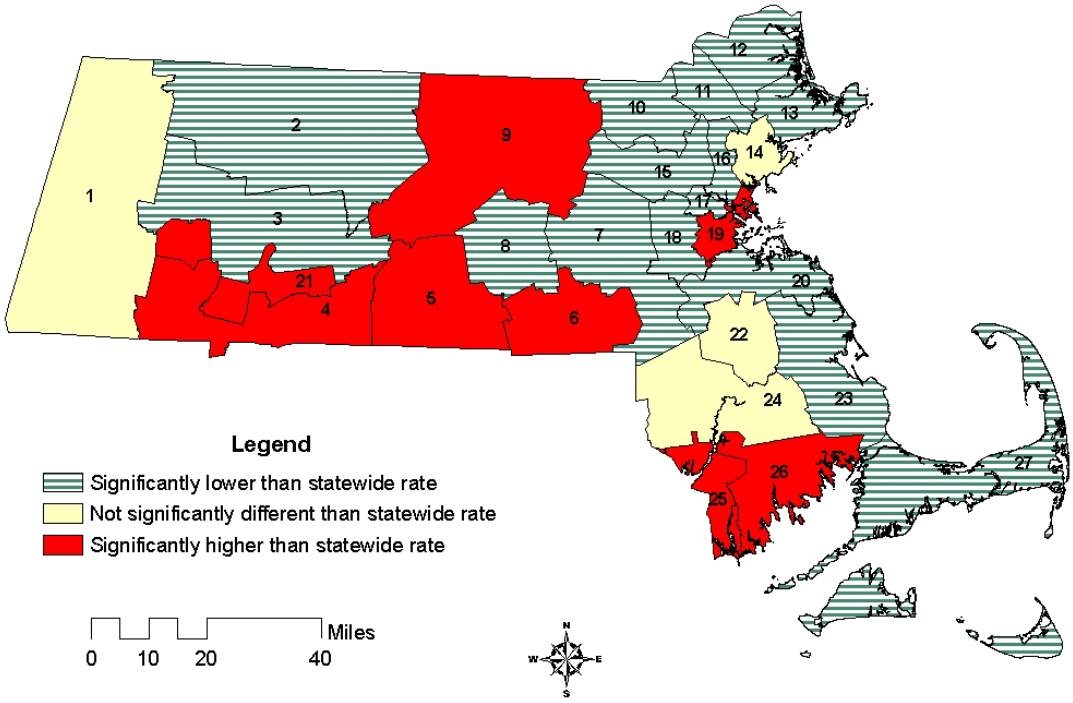


	Black			Hispanic			White		
Year	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]
2000	451	11.9	10.7-13.0	520	12.6	11.3-14.0	2,058	4.2	4.0-4.4
2001	437	11.1	10.0-12.1	424	9.0	8.0-9.9	1,834	3.8	3.7-4.0
2002	382	9.5	8.5-10.4	400	8.3	7.4-9.3	1,631	3.4	3.2-3.6
2003	373	9.5	8.5-10.5	420	8.3	7.4-9.2	1,598	3.4	3.2-3.5
2004	380	9.6	8.6-10.6	400	8.3	7.3-9.2	1,385	2.9	2.8-3.1
2005	328	8.5	7.5-9.4	366	7.7	6.8-8.7	1,291	2.7	2.5-2.8

[1]Rate of observation stays for asthma per 10,000 residents. Age-adjusted to US 2000 Population.
[2]95% Confidence Interval of the age-adjusted rate.
Note: Table excludes American Indian, non-Hispanic race and Asian/Pacific Islander due to small estimates.
Data Source: CY2000-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy.

- From 2000 through 2005, Blacks and Hispanics consistently had highest age-adjusted rates of observation stays due to asthma than Whites. With the exception of 2000, the highest age-adjusted rates were highest among Blacks for each year examined.
- In 2005, relative to the age-adjusted rate among Whites, the rate among Blacks was 3.1 times higher and among Hispanics was 2.9 times higher.
- From 2000 through 2005, the age-adjusted rates decreased
    - 38.9% among Hispanics from 12.6 to 7.7 per 10,000 residents (ρ=-0.8804, p=0.0206).
    - 35.7% among Whites from 4.2 to 2.7 per 10,000 residents (ρ=-0.9856, p=0.0003).
    - 28.6% among Blacks from 11.9 to 8.5 per 10,000 residents (ρ=-0.8117, p=0.0499).

Map 4.2: Three-year Average Annual Age-adjusted Rate of Observation Stays due to Asthma by Community Health Network Area (CHNA) of Residence, 2003-2005
Massachusetts Residents



Data Source: CY2003-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

- The three-year average annual age-adjusted rates of observation stays due to asthma were not evenly distributed among the 27 Community Health Network Area's (CHNA) across the state.
- The overall Massachusetts three-year average annual age-adjusted rate was 3.8 per 10,000 residents; rates in 15 CHNA's were lower and in 8 CHNA's were higher than the statewide rate.
- Among the 27 CHNA's, the three-year average annual age-adjusted rate was highest in CHNA 5: Community Health Network of Southern Worcester County (9.5 per 10,000) and lowest in CHNA 11: Greater Lawrence Community Health Network (1.6 per 10,000).
- The three-year average annual age-adjusted rate in 8 CHNA's was higher than the statewide rate (see table on next page).

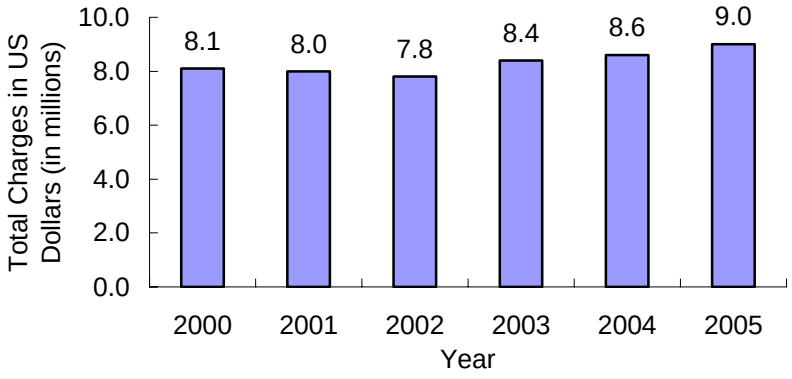
Map 4.2 (continued): Three-year Average Annual Age-adjusted Rates of Observation Stays due to Asthma by Community Health Network Area (CHNA) of Residence, 2003-2005

Massachusetts Residents

Community Health Network Area (CHNA)	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1. Community Health Network of Berkshire	123	3.1	3.9	3.2-4.6
2. Upper Valley Health Web (Franklin County)	55	2.1	2.4	1.8-3.1
3. Partnership for Health in Hampshire County (Northampton)	91	2.0	2.7	2.1-3.2
4. The Community Health Connection (Springfield)	582	6.5	6.7	6.2-7.3
5. Community Health Network of Southern Worcester County	315	8.9	9.5	8.5-10.6
6. Community Partners for Health (Milford)	292	6.1	5.9	5.2-6.6
7. Community Health Network of Greater Metro West (Framingham)	369	3.2	3.2	2.9-3.6
8. Common Pathways (Worcester)	199	2.2	2.3	2.0-2.7
9. Community Health Network of Central Massachusetts	398	5.1	5.2	4.7-5.7
10. Greater Lowell Community Health Network	196	2.4	2.4	2.0-2.7
11. Greater Lawrence Community Health Network	99	1.7	1.6	1.3-1.9
12. Greater Haverhill Community Health Network	97	2.2	2.3	1.8-2.7
13. Greater Beverly/ Gloucester Community Health Network	58	1.6	1.8	1.3-2.3
14. North Shore Community Health Network	274	3.2	3.4	3.0-3.8
15. Northwest Suburban Health Alliance	147	2.3	2.3	1.9-2.7
16. North Suburban Health Alliance (Medford/Malden/Melrose)	134	1.7	1.8	1.5-2.2
17. Greater Cambridge/Somerville Community Health Network	134	1.6	1.8	1.5-2.2
18. West Suburban Health Network (Newton/Waltham)	159	2.1	2.3	1.9-2.6
19. Alliance for Community Health (Boston/Chelsea/Revere/Winthrop)	1,234	5.7	6.1	5.7-6.4
20. Blue Hills Community Health Alliance (Quincy)	288	2.6	2.7	2.4-3.1
21. Community Health Network of Chicopee-Holyoke-Ludlow-Westfield	242	5.0	5.4	4.7-6.1
22. Greater Brockton Community Health Network	299	4.1	4.2	3.7-4.7
23. South Shore Community Health Network	172	3.1	3.1	2.6-3.6
24. Greater Attleboro-Taunton Health Education	280	3.7	3.8	3.3-4.2
25. Partners for Healthier Communities (Fall River)	196	4.6	4.9	4.2-5.6
26. Greater New Bedford Community Health Network	377	6.3	7.2	6.5-7.9
27. Cape Cod and Islands Community Health Network	136	1.8	2.3	1.9-2.7
Massachusetts Total	6,947	3.6	3.8	3.7-3.9

[1]Three-year average annual crude rate of observation stays due to asthma per 10,000 residents.
[2]Three-year average annual age-adjusted rate of observation stays due to asthma per 10,000 residents. Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Note: Highlighted rows indicate CHNA's with a three-year average annual age-adjusted rate that was higher than the statewide rate.
Data Source: CY2003-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

Figure 4.13: Total Charges for Observation Stays due to Asthma, 2000-2005
Massachusetts Residents



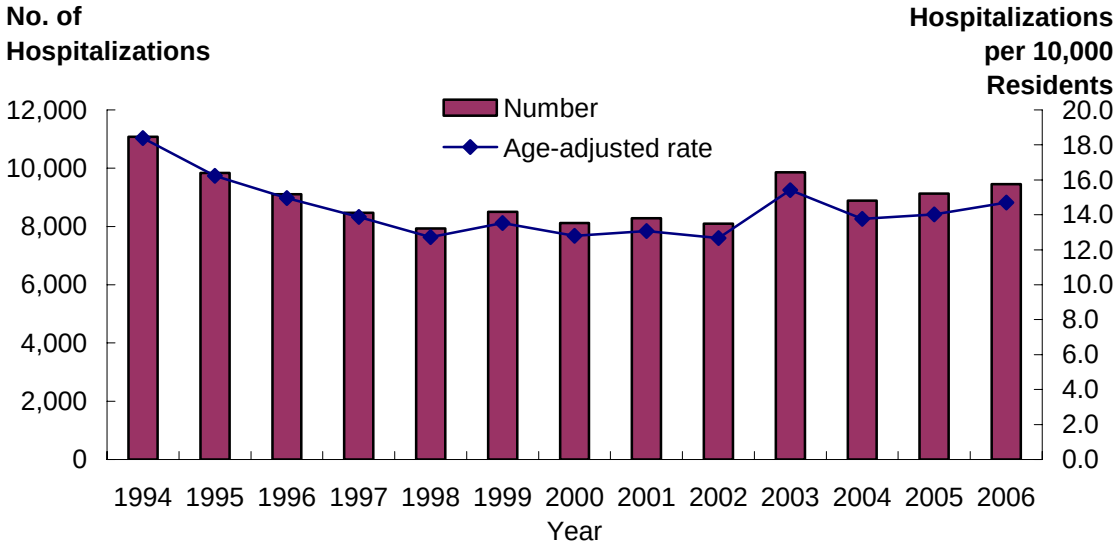
Year	Total Charges	Mean Charge	Median Charge
2000	$8,071,646	$2,501	$2,244
2001	$7,965,267	$2,753	$2,443
2002	$7,812,829	$3,047	$2,637
2003	$8,359,898	$3,300	$2,920
2004	$8,577,289	$3,707	$3,312
2005	$8,970,855	$4,270	$3,849

Data Source: CY2000-2005 Massachusetts Outpatient Observation Stays Database, Massachusetts Department of Public Health

- For observation stays due to asthma from 2000 through 2005, the combined total charges for all years were $49.7 million. This was an average of $8.3 million each year.
- During this time period, the total charges for observation stays due to asthma remained relatively stable.
    - Mean charges per visit increased 70.7% from $2,501 in 2000 to $4,270 in 2005 ($\rho$=1.000, p<0.0001).
    - Median charges per visit increased 71.5% from $2,244 in 2000 to $3,849 in 2005 ($\rho$=1.000, p<0.0001).

Figure 4.14: Number and Age-adjusted Rate of Hospitalization due to Asthma, 1994-2006

Massachusetts Residents

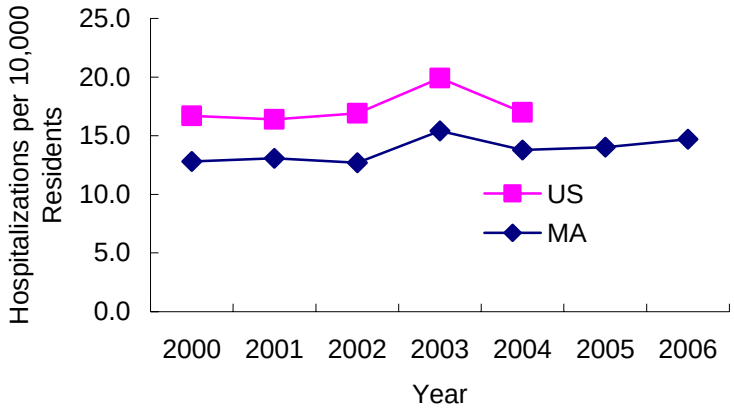


Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1994	11,078	18.1	18.4	18.0-18.7
1995	9,839	16.0	16.2	15.9-16.6
1996	9,102	14.7	15.0	14.6-15.3
1997	8,471	13.6	13.9	13.6-14.2
1998	7,932	12.6	12.7	12.4-13.0
1999	8,497	13.4	13.5	13.2-13.8
2000	8,118	12.8	12.8	12.5-13.1
2001	8,283	12.9	13.1	12.8-13.4
2002	8,100	12.6	12.7	12.4-13.0
2003	9,865	15.3	15.4	15.1-15.7
2004	8,888	13.8	13.8	13.5-14.1
2005	9,121	14.2	14.0	13.7-14.3
2006	9,457	14.7	14.7	14.4-15.0

[1]Rate of hospitalizations due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: MA Data: CY1994-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy

- From 1994 through 2006, there were 116,751 hospitalizations due to asthma among Massachusetts residents. This means:
    - An average of 8,981 hospitalizations for asthma occurred every year, and
    - An average of 25 hospitalizations for asthma occurred every day.
- From 1994 through 1998, the Massachusetts age-adjusted rate decreased 31.0% from 18.4 to 12.7 per 10,000 residents (ρ=-1.000, p <0.0001). From 1999 through 2006, the rate increased 8.9% from 13.5 to 14.7 per 10,000 residents; however this increase was not statistically significant (ρ=0.643, p=0.086).

Figure 4.15: Massachusetts and the US Age-adjusted Rates of Hospitalization due to Asthma, 2000-2006
Massachusetts Residents and US Residents

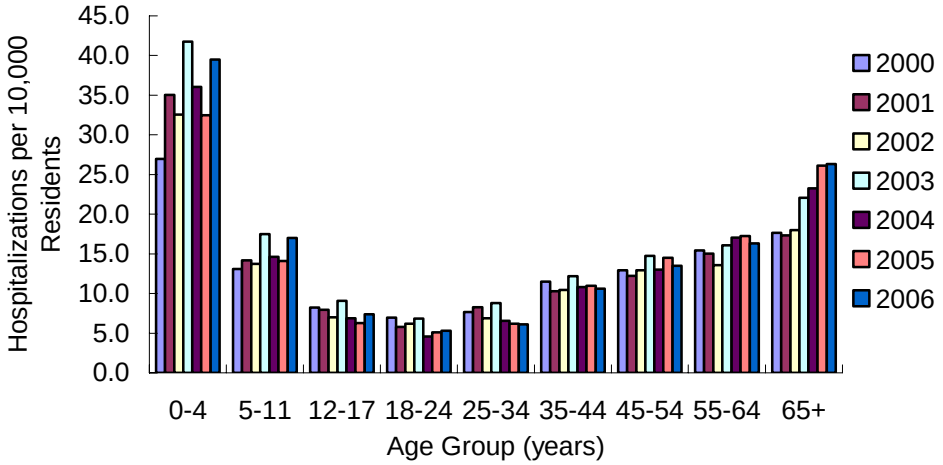


	Massachusetts				US
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	Age-adjusted rate[2]
2000	8,118	12.8	12.8	12.5-13.1	16.7
2001	8,283	13.1	13.1	12.8-13.4	16.4
2002	8,100	12.7	12.7	12.4-13.0	16.9
2003	9,865	15.4	15.4	15.1-15.7	19.9
2004	8,888	13.8	13.8	13.5-14.1	17.0
2005	9,121	14.0	14.0	13.7-14.3	NA
2006	9,457	14.7	14.7	14.4-15.0	NA

[1]Rate of hospitalizations due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate in MA.
NA=National data were not available (NA) for 2005 and 2006 at the time this report was published.
Data Source: MA Data: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy; US Data: CY2000-2004 National Hospital Discharge Survey, National Center for Health Statistics.

- Compared to the US, Massachusetts consistently had lower age-adjusted rates of hospitalization due to asthma in all years for which both US and Massachusetts data are available.

Figure 4.16: Age-Specific Rate of Hospitalization due to Asthma, 2000-2006
Massachusetts Residents



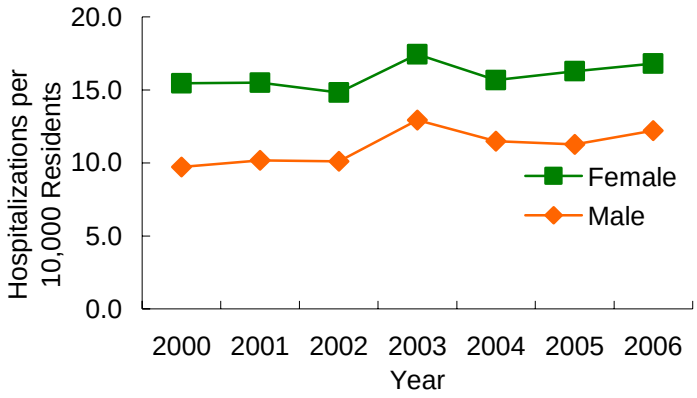
Age Group	0-4		5-11		12-17		18-24	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2000	1,071	27.0	797	13.1	408	8.2	405	7.0
2001	1,391	35.0	855	14.2	401	8.0	342	5.8
2002	1,290	32.5	810	13.8	360	7.0	371	6.2
2003	1,649	41.7	1,007	17.5	471	9.1	416	6.8
2004	1,419	36.1	825	14.6	356	6.9	285	4.6
2005	1,271	32.4	780	14.1	324	6.3	320	5.1
2006	1,532	39.5	934	17.0	380	7.4	336	5.3

Age Group	25-34		35-44		45-54		55-64		65+	
Year	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]	No.	Rate[1]
2000	710	7.7	1,221	11.5	1,140	12.9	848	15.4	1,518	17.6
2001	754	8.3	1,095	10.3	1,110	12.2	847	15.0	1,488	17.3
2002	618	6.9	1,103	10.4	1,187	13.0	817	13.6	1,544	18.0
2003	776	8.8	1,271	12.2	1,371	14.7	1,010	16.1	1,894	22.1
2004	561	6.5	1,109	10.8	1,227	13.0	1,116	17.0	1,990	23.2
2005	519	6.2	1,110	11.0	1,390	14.5	1,172	17.2	2,235	26.1
2006	505	6.1	1,053	10.6	1,315	13.5	1,148	16.3	2,254	26.3

[1]Rate of hospitalizations due to asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2000-2005 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy

- From 2000 through 2006, the Massachusetts age-specific rates of hospitalization due to asthma were highest among children ages 0-4 years and adults ages 65+ years. This pattern in age-specific rates is similar to national findings.[3]
- Within the age group of adults ages 65 years and older, the age-specific rates increased 49.4% from 2000 through 2006 (17.6 to 26.3 per 10,000, respectively; ρ=0.964, p=0.0005).
- The rates among the children ages 0-4 years increased 46.3% from 27.0 to 39.5 per 10,000 residents; however this trend was not statistically significant (ρ=0.4643, p=0.2939).

Figure 4.17: Age-Adjusted Rate of Hospitalization due to Asthma by Sex, 2000-2006
Massachusetts Residents

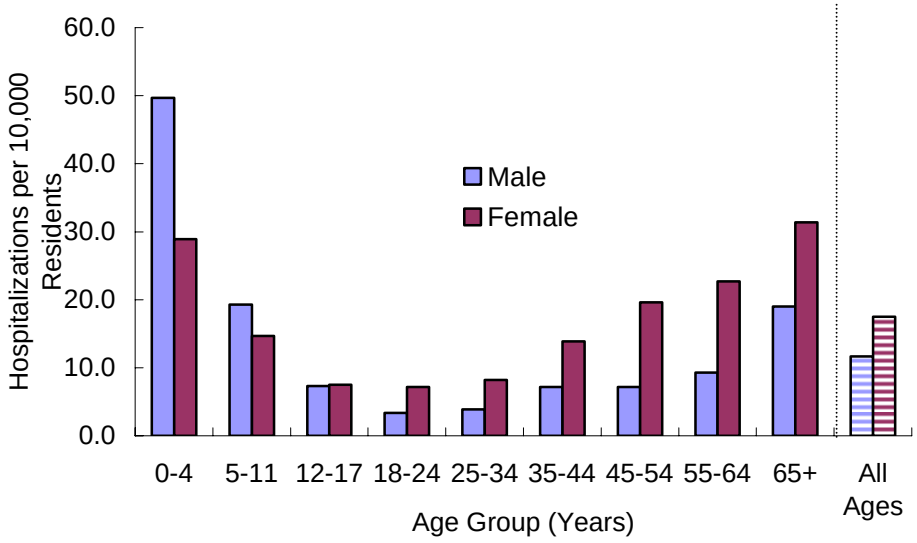


	Male				Female			
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
2000	2,918	9.5	9.7	9.4-10.1	5,200	15.8	15.4	15.0-15.9
2001	3,049	9.9	10.2	9.8-10.6	5,234	15.8	15.5	15.1-15.9
2002	3,055	9.8	10.1	9.8-10.5	5,045	15.2	14.8	14.4-15.2
2003	3,904	12.5	12.9	12.5-13.3	5,961	17.9	17.5	17.0-17.9
2004	3,468	11.1	11.5	11.1-11.9	5,420	16.3	15.7	15.2-16.1
2005	3,401	10.9	11.3	10.9-11.6	5,720	17.3	16.3	15.9-16.7
2006	3,648	11.7	12.2	11.8-12.6	5,809	17.5	16.8	16.3-17.2

[1]Rate of hospitalizations due to asthma per 10,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.

- From 2000 through 2006, the age-adjusted rates of hospitalization due to asthma increased slightly for both males (ρ=0.714, p=0.071) and females (ρ=0.679, p=0.094); however this trend was not statistically significant.
- During this time period, the age-adjusted rates were consistently higher among females than males.

Figure 4.18: Age-Sex-Specific Rate of Hospitalization due to Asthma, 2006
Massachusetts Residents

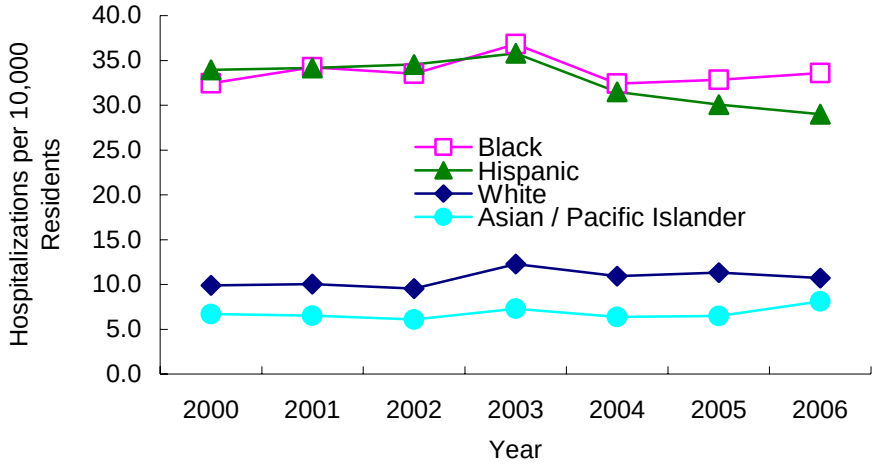


	Male		Female	
Age Group	**No.**	**Rate[1]**	**No.**	**Rate[1]**
0-4	983	49.7	549	28.9
5-11	540	19.3	394	14.7
12-17	193	7.3	187	7.5
18-24	106	3.4	230	7.2
25-34	163	3.9	342	8.2
35-44	352	7.2	701	13.9
45-54	339	7.2	976	19.6
55-64	312	9.3	836	22.7
65+	660	19	1,594	31.4
All ages	3,648	11.7	5,809	17.5

[1]Rate of hospitalizations due to asthma per 10,000 residents.
Note: Data table with 95% Confidence Intervals is available in Appendix B.
Data Source: CY2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.

- In 2006, the Massachusetts age-specific rates of hospitalizations due to asthma varied by sex.
- In the 0-4 and 5-11 age subgroups, males had higher age-specific rates compared to females. Starting in the 18-24 age subgroup, the age-specific rates were higher among females than males.

Figure 4.19: Age-Adjusted Rate of Hospitalization due to Asthma by Race/Ethnicity, 2000-2006
Massachusetts Residents



	Black			Hispanic		
Year	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]
2000	1,151	32.5	30.5 - 34.4	1,071	34.0	31.4 - 36.6
2001	1,237	34.2	32.2 - 36.2	1,149	34.2	31.7 - 36.7
2002	1,218	33.5	31.6 - 35.5	1,207	34.5	32.2 - 36.9
2003	1,353	36.8	34.8 - 38.9	1,414	35.8	33.5 - 38.1
2004	1,206	32.4	30.5 - 34.3	1,238	31.5	29.4 - 33.6
2005	1,213	32.8	30.9- 34.8	1,183	30.1	28.0 - 32.1
2006	1,300	33.6	31.7 - 35.5	1,181	29.0	27.1 - 30.9

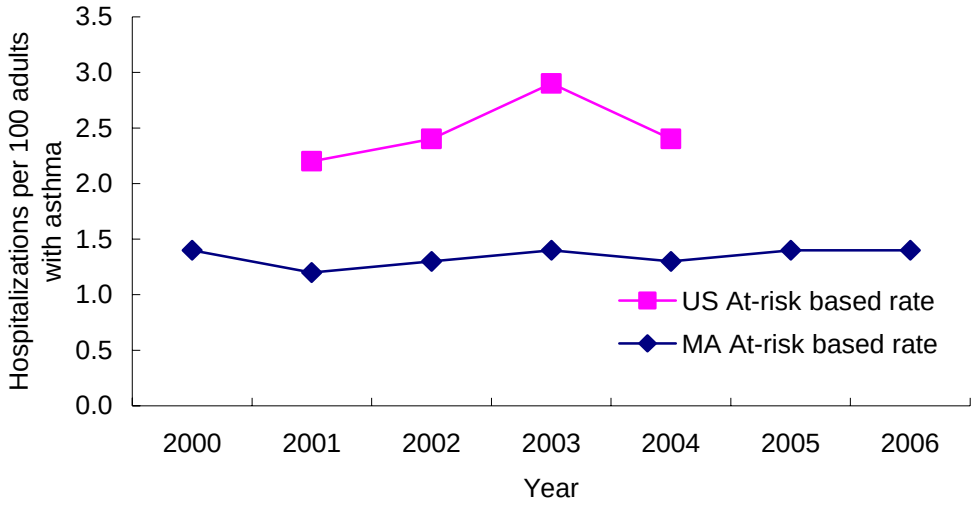
	White			Asian/Pacific Islander		
Year	No.	Rate[1]	95% CI[2]	No.	Rate[1]	95% CI[2]
2000	5,346	9.9	9.6 - 10.2	145	6.7	5.5 - 7.9
2001	5,365	10.1	9.8 - 10.3	141	6.5	5.3 - 7.7
2002	5,134	9.6	9.3 - 9.8	147	6.1	5.0 - 7.2
2003	6,549	12.3	12.0 - 12.6	176	7.3	6.1 - 8.5
2004	5,930	10.9	10.6 - 11.2	164	6.4	5.3 - 7.4
2005	6,205	11.3	11.0 - 11.6	155	6.5	5.4 - 7.6
2006	5,783	10.7	10.4 - 11.0	198	8.1	6.9 - 9.3

[1]Rate of hospitalizations due to asthma per 10,000 residents. Age-adjusted to US 2000 Population.
[2]95% Confidence Interval of the age-adjusted rate.
Note: Data excludes 8 cases of American Indian, non-Hispanic race.
Data Source: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.

- From 2000 through 2006, Blacks and Hispanics consistently had substantially higher age-adjusted rates of hospitalization due to asthma than Whites. During this time period, Asian/Pacific Islanders consistently had lower age-adjusted rates than Whites.
- In 2006, relative to the age-adjusted rate among Whites, the rate among Blacks was 3.1 times higher and among Hispanics was 2.7 times higher.
- Within each race/ethnicity category, the age-adjusted rate of hospitalizations due to asthma remained relatively stable from 2000 through 2006.

- Among Hispanics, the age-adjusted rate decreased 14.7% from 34.0 to 29.0 in 2000 through 2006; however, this trend was not statistically significant (ρ=-0.6429, p=0.1194).

Figure 4.20: At-Risk Based Rates of Hospitalization due to Asthma, 2000-2006
Massachusetts Adults with Current Asthma Ages 18+ Years



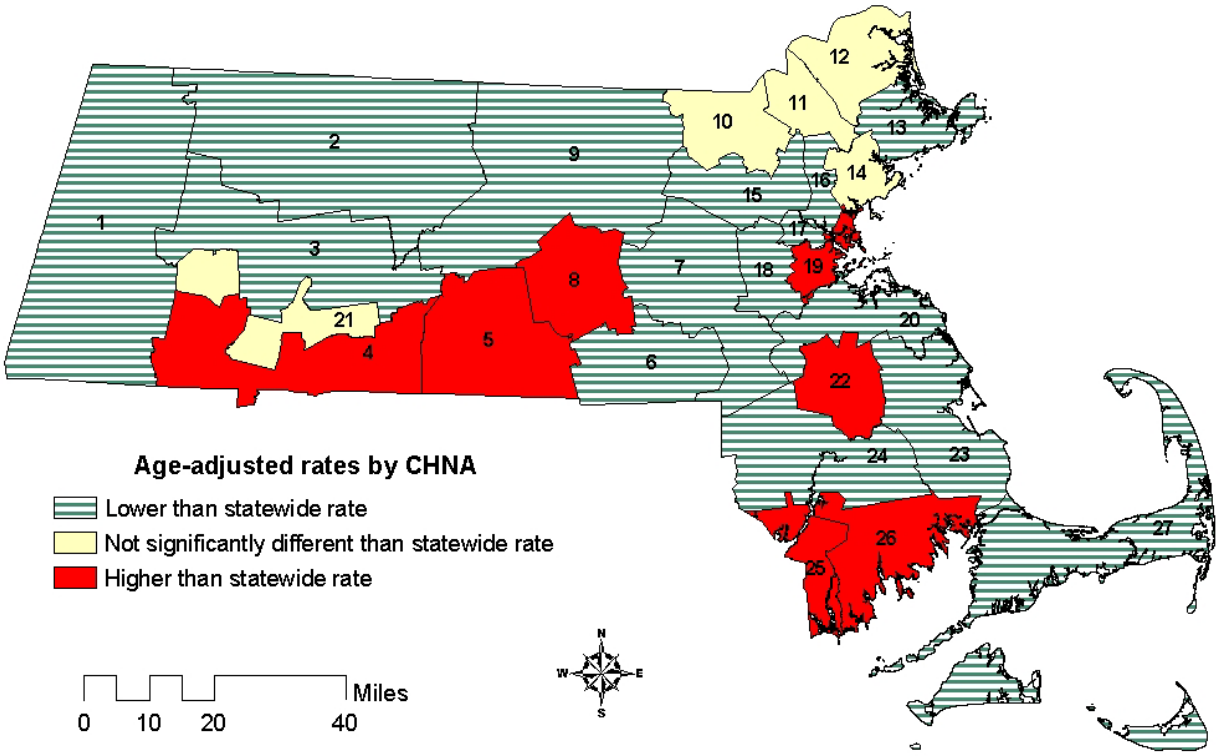
Year	MA No.[1]	MA At-risk based rate[2]	MA 95% CI[3]	US At-risk based rate[2]
2000	5,842	1.4	1.36-1.44	NA
2001	5,636	1.2	1.17-1.23	2.2
2002	5,640	1.3	1.27-1.33	2.4
2003	6,738	1.4	1.37-1.43	2.9
2004	6,288	1.3	1.27-1.33	2.4
2005	6,746	1.4	1.37-1.43	NA
2006	6,611	1.4	1.37-1.43	NA

[1]Number of hospitalizations due to asthma among adults ages 18-64 years.
[2]Number of hospitalizations due to asthma per 100 persons with current asthma ages 18 years and older .
[3]95% Confidence Interval of the MA at-risk based rate.
Note: National data were not available (NA) for 2000, 2005, and 2006 at the time this report was published.
Data Source: MA Data: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy. 2000-2006 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health. US Data: 2001-2004 National Hospital Discharge Survey, National Center for Health Statistics.

The at-risk based rate of hospitalization due to asthma was calculated as the number of hospitalizations due to asthma among adults with current asthma at that time. The at-risk based rate was used to determine if the changes in hospitalizations due to asthma over time are explained by the increase in asthma prevalence.

- From 2000 through 2006, the Massachusetts at-risk based rate among adults remained stable. This means:
    - After adjusting for the increase in the prevalence of current asthma in Massachusetts, the hospitalization rate due to asthma remained stable.
- Compared to the US, Massachusetts had a lower at-risk based rate for all the years for which both US and Massachusetts data were available.

Map 4.3: Three-year Average Annual Age-adjusted Rate of Hospitalization due to Asthma by Community Health Network Area (CHNA) of Residence, 2004-2006
Massachusetts Residents



Data Source: CY2004-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.

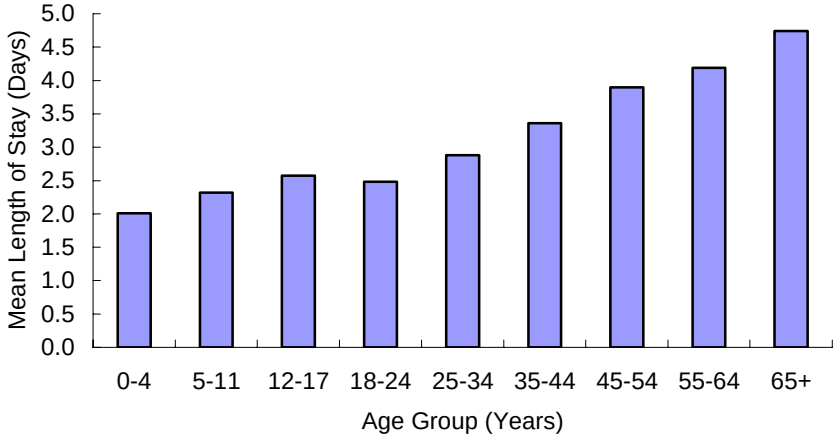
- The three-year average annual age-adjusted rates of hospitalization due to asthma were not evenly distributed among the Community Health Network Area's (CHNA) across the state.
- The overall Massachusetts three-year average annual age-adjusted rate was 14.1 per 10,000 residents; rates in 15 CHNA's were lower and in 7 CHNA's were higher than the statewide rate.
- Among the 27 CHNA's, the three-year average annual age-adjusted rate was highest in CHNA 25: Partners for Healthier Communities (29.3 per 10,000) and lowest in CHNA 18: West Suburban Health Network (7.1 per 10,000).
- The three-year average annual age-adjusted rate in 7 Community Health Network Area's (CHNA) was higher than the statewide rate (see table on next page).

Map 4.3 (continued): Three-year Average Annual Age-adjusted Rates of Hospitalization due to Asthma by Community Health Network Area (CHNA) of Residence, 2004-2006
Massachusetts Residents

Community Health Network Area (CHNA)	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1. Community Health Network of Berkshire	347	8.8	9.0	8.0-9.9
2. Upper Valley Health Web (Franklin County)	249	9.4	9.4	8.2-10.6
3. Partnership for Health in Hampshire County (Northampton)	346	7.6	8.4	7.4-9.3
4. The Community Health Connection (Springfield)	1,465	16.3	16.1	15.3-16.9
5. Community Health Network of Southern Worcester County	580	16.2	16.0	14.7-17.4
6. Community Partners for Health (Milford)	434	9.0	9.0	8.2-9.9
7. Community Health Network of Greater Metro West (Framingham)	1,205	10.6	10.4	9.8-11.0
8. Common Pathways (Worcester)	1,505	16.5	16.6	15.7-17.4
9. Community Health Network of Central Massachusetts	1,002	12.8	12.8	12.0-13.6
10. Greater Lowell Community Health Network	1,126	13.8	13.8	13.0-14.6
11. Greater Lawrence Community Health Network	837	14.3	14.0	13.1-15.0
12. Greater Haverhill Community Health Network	633	14.2	14.1	13.0-15.2
13. Greater Beverly/ Gloucester Community Health Network	489	13.7	12.9	11.7-14.1
14. North Shore Community Health Network	1,218	14.1	13.6	12.8-14.3
15. Northwest Suburban Health Alliance	573	9.1	8.6	7.9-9.4
16. North Suburban Health Alliance (Medford/Malden/Melrose)	996	12.9	12.6	11.8-13.4
17. Greater Cambridge/Somerville Community Health Network	679	8.3	9.6	8.9-10.4
18. West Suburban Health Network (Newton/Waltham)	555	7.3	7.1	6.5-7.7
19. Alliance for Community Health (Boston/Chelsea/Revere/Winthrop)	4,928	23.1	25.5	24.7-26.2
20. Blue Hills Community Health Alliance (Quincy)	1,440	12.9	12.5	11.8-13.1
21. Community Health Network of Chicopee-Holyoke-Ludlow-Westfield	702	14.5	14.1	13.1-15.2
22. Greater Brockton Community Health Network	1,369	18.8	19.0	18.0-20.0
23. South Shore Community Health Network	670	11.8	11.8	10.9-12.7
24. Greater Attleboro-Taunton Health Education	807	10.6	10.7	9.9-11.4
25. Partners for Healthier Communities (Fall River)	1,256	29.5	29.3	27.6-30.9
26. Greater New Bedford Community Health Network	1,408	23.5	22.5	21.3-23.7
27. Cape Cod and Islands Community Health Network	648	8.6	8.0	7.3-8.6
Massachusetts Total	27,466	14.2	14.1	14.0-14.3

[1]Three-year average annual crude rate of hospitalizations due to asthma per 10,000 residents.
[2]Three-year average annual age-adjusted rate of hospitalizations due to asthma per 10,000 residents. Age-adjusted to US 2000 Population.
[2]95% Confidence Interval of the age-adjusted rate.
Note: Highlighted rows indicate CHNA's with a three-year average annual age-adjusted rate that was higher than the statewide rate.
Data Source: CY2004-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy

Figure 4.21: Average Length of Stay of Hospitalizations due to Asthma by Age Group, 2006
Massachusetts Residents

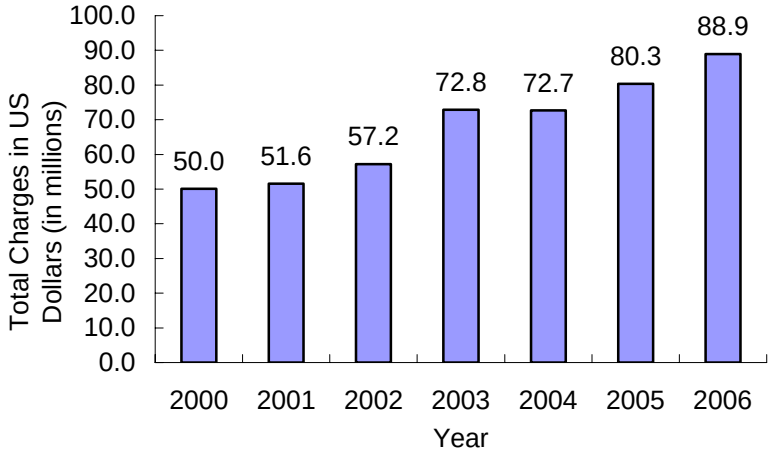


	Length of Stay (Days)			
Age Group	**Mean**	**Median**	**Minimum**	**Maximum**
0-4	2.0	2	1	45
5-11	2.4	2	1	11
12-17	2.7	2	1	29
18-24	2.5	2	1	40
25-34	2.9	2	1	46
35-44	3.4	3	1	25
45-54	3.9	3	1	30
55-64	4.2	3	1	64
65+	4.7	4	1	85

Data Source: CY2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy.

- In 2006, the average length of stay for a hospitalization due to asthma increased with age from a low of 2.0 days among children ages 0-4 years to a high of 4.7 days among adults ages 65+ years.

Figure 4.22: Total Charges for Hospitalizations due to Asthma in Massachusetts, 2000-2006
Massachusetts Residents

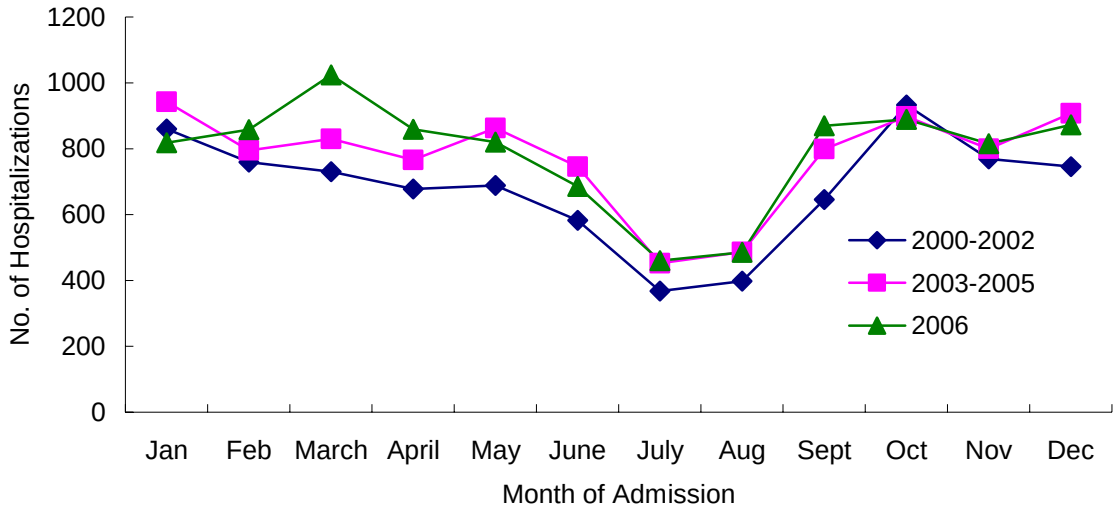


Year	Total Charges	Mean Charge	Median Charge
2000	$50,049,809	$6,169	$4,425
2001	$51,584,325	$6,235	$4,486
2002	$57,155,871	$7,069	$4,946
2003	$72,845,793	$7,393	$5,257
2004	$72,659,660	$8,175	$5,893
2005	$80,309,450	$8,809	$6,484
2006	$88,935,151	$9,404	$6,801

Data Source: CY2000-2006 Massachusetts Inpatient Discharge Database, Massachusetts Health Care Finance and Policy

- For hospitalizations due to asthma from 2000 through 2006, the combined total charges were over $473.5 million. This was an average of $67.6 million per year.
- During this time period, the total annual charges for hospitalization due to asthma increased 77.7% from $50 million in 2000 to $89 million in 2006 (not adjusted for inflation) (ρ=0.964, p=0.0005).
    - Mean charges per visit increased 52.4% from $6,169.09 to $9,404.16 ($\rho$=1.00, p<0.0001).
    - Median charges per visits increased 53.7% from $4,425 to $6,801 ($\rho$=1.00, p<0.0001).
- In 2006, public insurance (including Free Care, Medicare, and Medicaid) was the expected payer for 62.6% of hospitalizations due to asthma.

Figure 4.23: Three-year Average Number of Hospitalizations due to Asthma by Month of Admission, 2000-2002, 2003-2005, 2006
Massachusetts Residents



	Year							
Month	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Total**
Jan	984	788	808	820	928	1,079	818	6,225
Feb	723	711	843	724	827	833	858	5,519
March	720	711	758	775	838	878	1,024	5,704
April	623	821	589	780	794	723	859	5,189
May	677	765	623	888	832	869	820	5,474
June	619	624	505	826	702	710	685	4,671
July	335	362	407	517	381	459	460	2,921
Aug	377	412	406	595	409	454	485	3,138
Sept	627	669	642	1,051	667	680	870	5,206
Oct	925	924	950	998	837	859	889	6,382
Nov	749	807	751	817	752	832	816	5,524
Dec	754	680	803	1,062	921	741	873	5,834
TOTAL	8,113	8,274	8,085	9,853	8,888	9,117	9,457	61,787

Data Source: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy.

- The seasonal pattern for the number of hospitalizations due to asthma was similar regardless of year. The highest frequency of hospital admissions due to asthma was in the fall/winter months and the lowest frequency was in the summer months.

A Look Across Hospital Settings

Examining the findings across different hospital settings highlights disparities in the burden of asthma among Massachusetts residents.

Figure 4.24: Percent Distribution of Emergency Department Discharges, Observation Stays, and Hospitalizations due to Asthma, 2002-2005

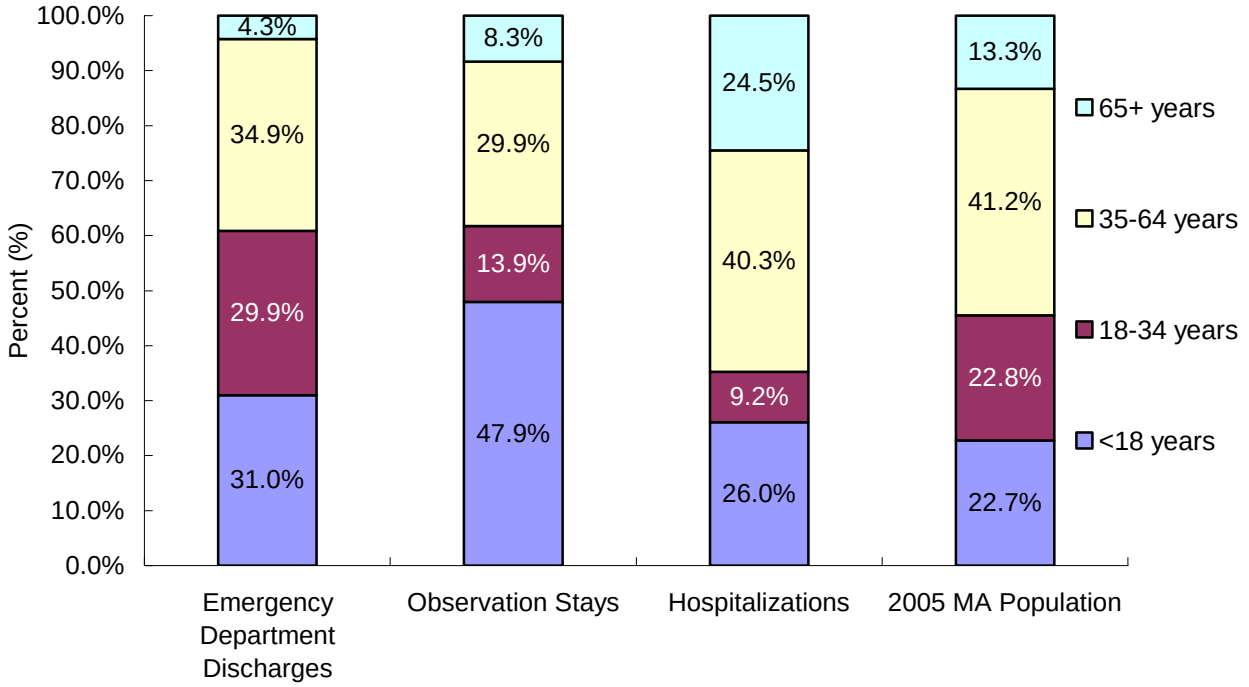
Massachusetts Residents

	Emergency Department Discharges		Observation Stays		Hospitalizations		Total
Year	No.	%	No.	%	No.	%	
2002	38,013	78.1	2,564	5.3	8,100	16.6	48,677
2003	40,155	76.4	2,534	4.8	9,865	18.8	52,554
2004	35,335	75.9	2,315	5.0	8,888	19.1	46,538
2005	36,146	76.3	2,101	4.4	9,121	19.3	47,368

Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Outpatient Observation Stays Discharge Database and Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.

- From 2002 through 2005, there was a combined average of 48,784 emergency department discharges, observation stays, and hospitalizations due to asthma each year.
- During this time period, approximately 77% of hospital-based episodes of care due to asthma occurred in the emergency department, 18% occurred as a hospital admission, and 5% occurred as an observation stay.

Figure 4.25: Percent Distribution of Emergency Department Discharges, Observation Stays, and Hospitalizations due to Asthma by Age Group, 2005
Massachusetts Residents

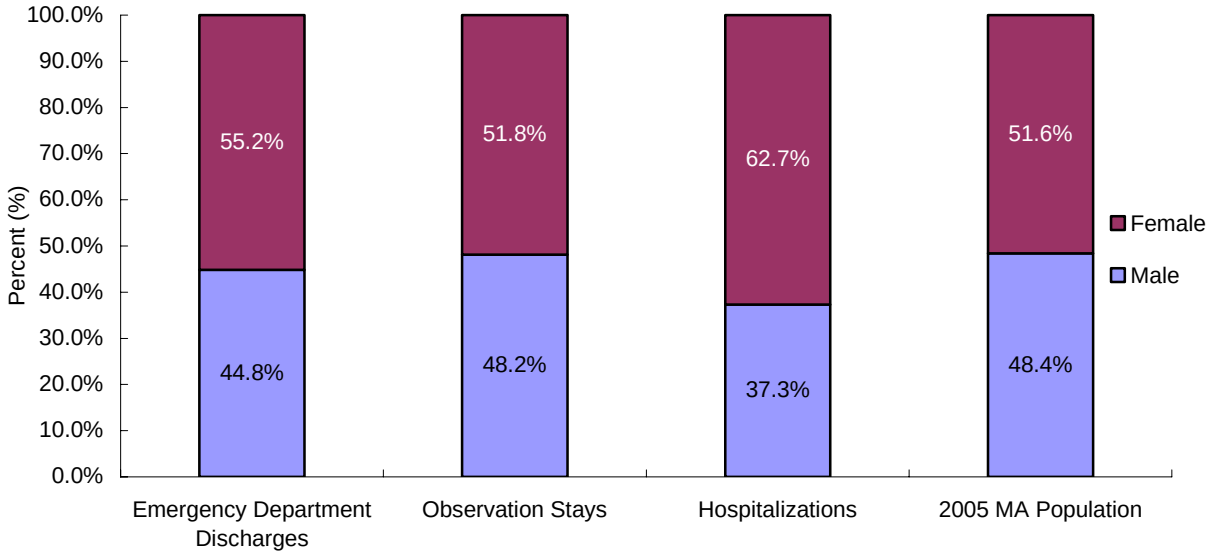


	Emergency Department Discharges		Observation Stays		Hospitalizations	
Age Group	**No.**	**%**	**No.**	**%**	**No.**	**%**
<18 years	11,205	31.0	1,007	47.9	2,375	26.0
18-34 years	10,797	29.9	291	13.9	839	9.2
35-64 years	12,598	34.9	628	29.9	3,672	40.3
65+ years	1,540	4.3	175	8.3	2,235	24.5
Total	36,146		2,101		9,121	

Note: The numbers may not add up to the total since age was missing for some visits.
Data Source: CY2005 Massachusetts Emergency Department Discharge Database, Outpatient Observation Stays Discharge Database, Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.
Population Data Source: Population Division, US Census Bureau, Annual Estimates of the Population by Age and Sex for Massachusetts: April 1, 2000 to July 1, 2006 (SC-EST2006-02-25), Released May 17, 2007

- In 2005, 61.8% of observation stays due to asthma and 60.9% of emergency department discharges due to asthma in Massachusetts occurred among those less than 35 years of age, an age group that comprised 45.5% of the Massachusetts population.
- 24.5% of hospitalizations due to asthma in Massachusetts occurred among those ages 65 years and over, an age group that comprised 13.3% of the Massachusetts population.

Figure 4.26: Percent Distribution of Emergency Department Discharges, Observation Stays, and Inpatient Hospitalizations due to Asthma by Sex, 2005
Massachusetts Residents

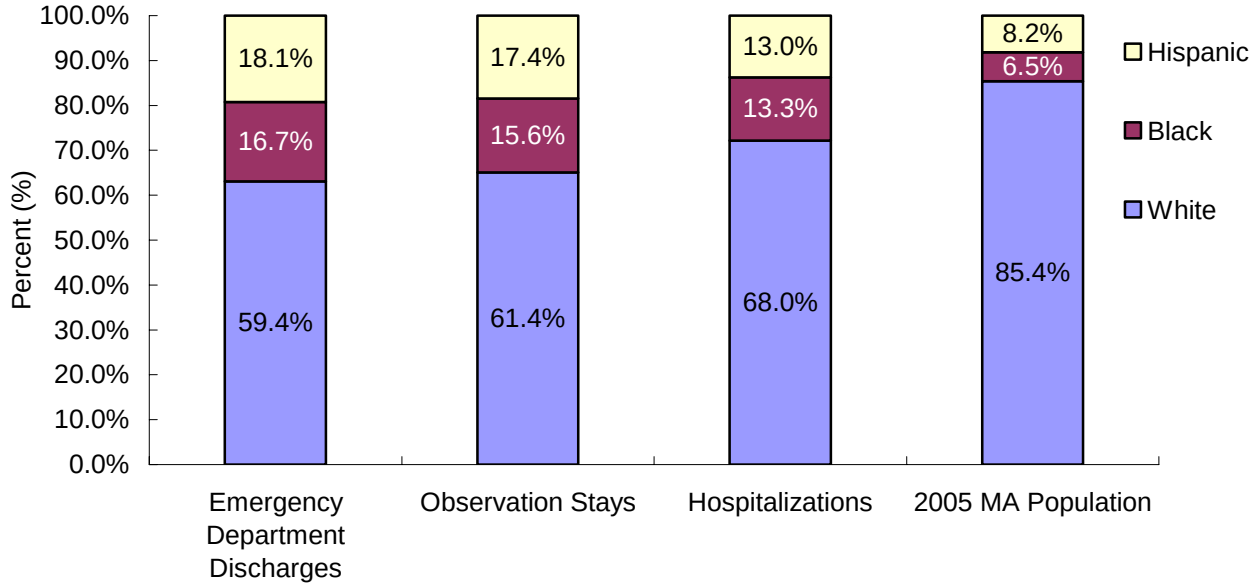


	Emergency Department Discharges		Observation Stays		Hospitalizations	
Sex	**No.**	**%**	**No.**	**%**	**No.**	**%**
Female	19,951	55.2	1,089	51.8	5,720	62.7
Male	16,194	44.8	1,012	48.2	3,401	37.3
Total	36,146		2,101		9,121	

Note: The numbers may not add up to the total since sex was missing for some visits.
Data Source: CY2005 Massachusetts Emergency Department Discharge Database, Outpatient Observation Stays Discharge Database, Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy.
Population Data Source: Population Division, US Census Bureau, Annual Estimates of the Population by Age and Sex for Massachusetts: April 1, 2000 to July 1, 2006 (SC-EST2006-02-25), Released May 17, 2007

- Females accounted for a disproportionate share of the emergency department discharges and hospitalizations due to asthma in Massachusetts. In 2005, females accounted for 55.2% of the emergency department discharges and 62.7% of hospitalizations due to asthma, a group that comprises 51.6% of the Massachusetts population.

Figure 4.27: Percent Distribution of Emergency Department Discharges, Observation Stays and Hospitalizations due to Asthma by Race/Ethnicity, 2005
Massachusetts Residents



	Emergency Department Discharges		Observation Stays		Hospitalizations	
Race/Ethnicity	**No.**	**%**	**No.**	**%**	**No.**	**%**
White	21,472	59.4%	1,291	61.4%	6,205	68.0%
Black	6,033	16.7%	328	15.6%	1,213	13.3%
Hispanic	6,544	18.1%	366	17.4%	1,183	13.0%
Total	36,146		2,101		9,121	

Note: The numbers may not add up to the total since the total includes counts from other race/ethnicity categories such as Asian/Pacific Islander and unknown race/ethnicity.
Data Source: CY2005 Massachusetts Emergency Department Discharge Database and CY2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy. US Census Bureau, Population Estimates Program Population Data Source: Population Division, US Census Bureau, Annual Estimates of the Population by Age and Sex for Massachusetts: April 1, 2000 to July 1, 2006 (SC-EST2006-02-25), Released May 17, 2007

- Blacks and Hispanics accounted for a disproportionate share of the emergency department discharges, observation stays and hospitalizations due to asthma in Massachusetts. In 2005, as a group that comprised only 8.2% of the Massachusetts population, Hispanics accounted for 18.1% of emergency department discharges, 17.4% of observation stays, and 13.0% of hospitalizations due to asthma. Blacks comprised 6.5% of the Massachusetts population, but accounted for 16.7% of emergency department discharges, 15.6% of observation stays, and 13.3% of hospitalizations due to asthma.

Section 5. Asthma Mortality

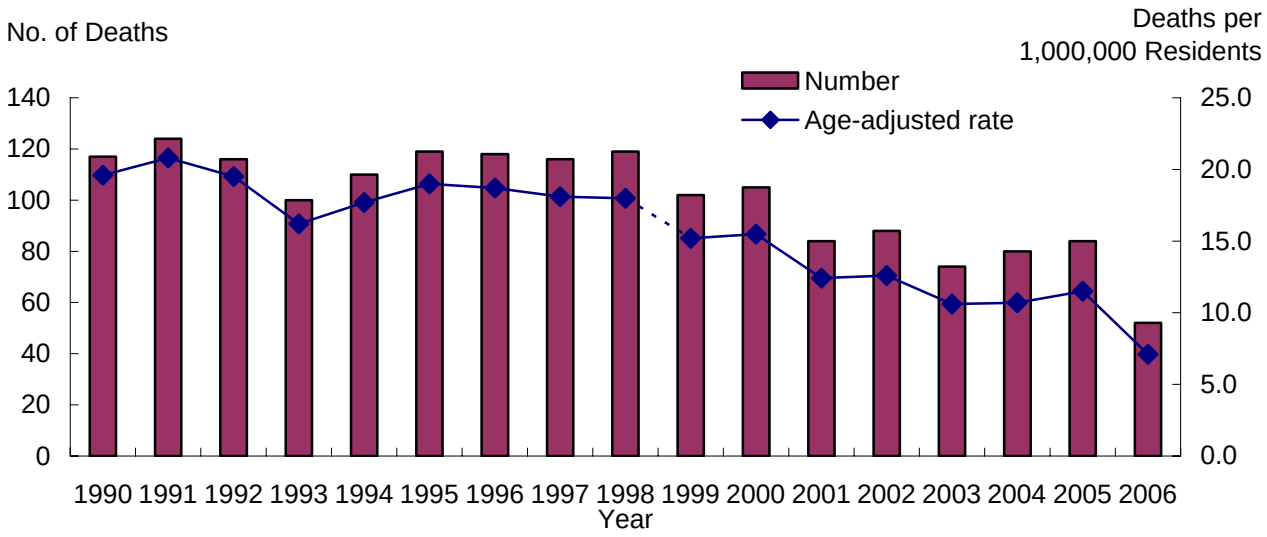
While asthma mortality is a rare event in Massachusetts, every death due to asthma is potentially avoidable. A death due to asthma is indicative of missed opportunities for appropriate asthma diagnosis, management and treatment.

In this section, the information on deaths occurring in Massachusetts is used to describe the trends in asthma mortality by demographic characteristics. Findings for deaths begin with a time trend since 1990. These data are followed by a more detailed examination of trends from 2000 forward, the data most relevant for current public health planning purposes. Cross-sectional findings are based on the most recent year(s) of data available, and in most instances, three to five years of data and certain age groups are aggregated to derive more stable estimates. Findings are compared to national estimates when possible.

Readers should be aware that in 1999, the coding scheme used to code cause of death was changed from International Classification of Disease, ninth version (ICD-9) to ICD-10. This change had particular impact on deaths among older individuals because of changes to the coding of deaths due to chronic obstructive pulmonary disease (COPD). Specifically, under ICD-9 death certificates that had COPD listed with asthma would have been coded as asthma deaths. Under ICD-10 these deaths would be coded as "other specified COPD". Because of this change, mortality data from 1999-2006 cannot be directly compared to data from 1990-1998.

The data source utilized in this section is the Massachusetts Registry of Vital Records and Statistics death data. Additional details of data considerations of this data source are provided in Appendix A.

Figure 5.1: Number and Age-adjusted Death Rates due to Asthma, 1990-2006
Massachusetts Residents



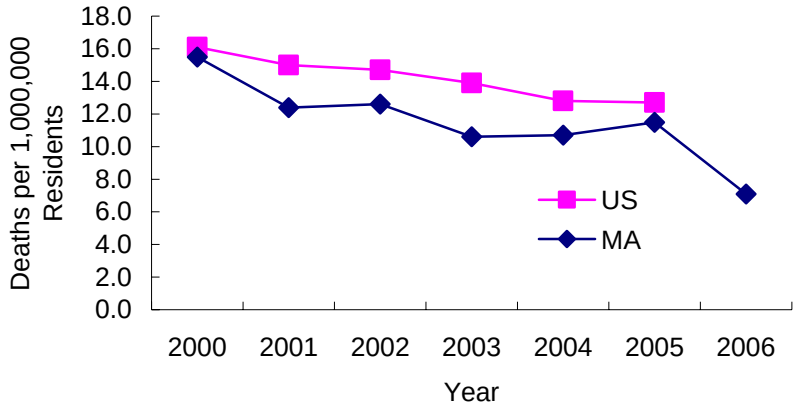
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1990	117	19.4	19.6	16.0 - 23.2
1991	124	20.6	20.8	17.1 - 24.5
1992	116	19.2	19.5	15.9 - 23.0
1993	100	16.5	16.2	13.0 - 19.4
1994	110	18.0	17.7	14.3 - 21.0
1995	119	19.4	19.0	15.5 - 22.4
1996	118	19.1	18.7	15.3 - 22.0
1997	116	18.6	18.1	14.8 - 21.4
1998	119	18.9	18.0	14.8 - 21.3
1999	102	16.1	15.2	12.2 - 18.2
2000	105	16.5	15.5	12.5 - 18.5
2001	84	13.1	12.4	9.7 - 15.0
2002	88	13.7	12.6	9.9 - 15.2
2003	74	11.5	10.6	8.2 - 13.0
2004	80	12.4	10.7	8.3 - 13.1
2005	84	13.0	11.5	9.0 - 14.0
2006	52	8.1	7.1	5.1 - 9.0

[1] Rate of deaths due to asthma per 1,000,000 residents.
[2] Age-adjusted to US 2000 Population.
[3] 95% Confidence Interval of the age-adjusted rate.
Note: In 1999 death coding changed from the ICD-9 classification to ICD-10 (dotted line). ICD-9 and ICD-10 codes used in this publication are listed in Appendix A.
Data Source: CY1990-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

- From 1990 through 2006, there were a total of 1,708 deaths due to asthma among Massachusetts residents.
- From 1990 through 2006, the Massachusetts asthma death rate decreased 63.8% from 19.6 to 7.1 per 1,000,000 residents (ρ=-0.922, p<0.0001).

Figure 5.2: Massachusetts and the US Age-adjusted Death Rates due to Asthma, 2000-2006

Massachusetts Residents and United States Residents

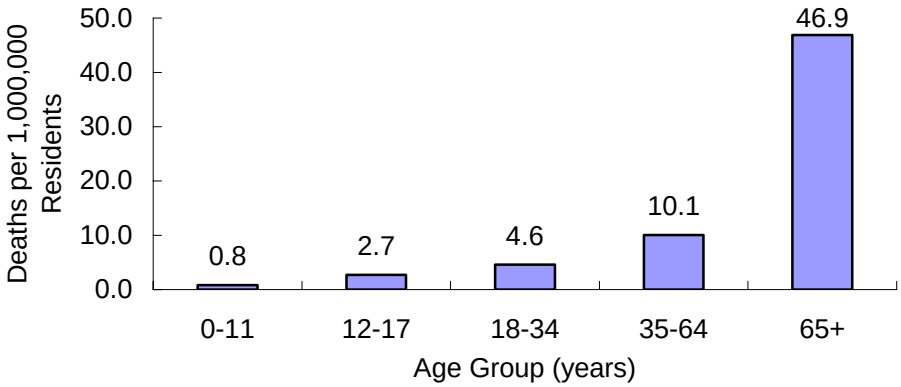


	Massachusetts				US
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	Age-adjusted rate[2]
2000	105	16.5	15.5	12.5 -18.5	16.1
2001	84	13.1	12.4	9.7 - 15.0	15.0
2002	88	13.7	12.6	9.9 - 15.2	14.7
2003	74	11.5	10.6	8.2 - 13.0	13.9
2004	80	12.4	10.7	8.3 - 13.1	12.8
2005	84	13.0	11.5	9.0- 14.0	12.7
2006	52	8.1	7.1	5.1 - 9.0	NA

[1] Rate of deaths due to asthma per 1,000,000 residents.
[2] Age-adjusted to US 2000 Population.
[3] 95% Confidence Interval of the age-adjusted rate.
NA=National data were not available (NA) for 2006 at the time this report was published.
Data Source: MA Data: CY2000-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health; US Data: CY2000-2005 National Vital Statistics System, National Center for Health Statistics

- From 2000 through 2006, the Massachusetts age-adjusted death rate due to asthma decreased 54% from 15.5 to 7.1 per 1,000,000 residents (ρ=-0.8214, p=0.0234).
- From 2000 through 2005, the US age-adjusted death rate decreased 21.2% from 16.1 to 12.7 per 1,000,000 residents (ρ=-1.000, p<0.0001).
- For the years examined, the annual age-adjusted death rate in Massachusetts was similar to, although remained slightly below, the US rate.

Figure 5.3: Five-year Average Annual Age-Specific Death Rate due to Asthma, 2002-2006
Massachusetts Residents

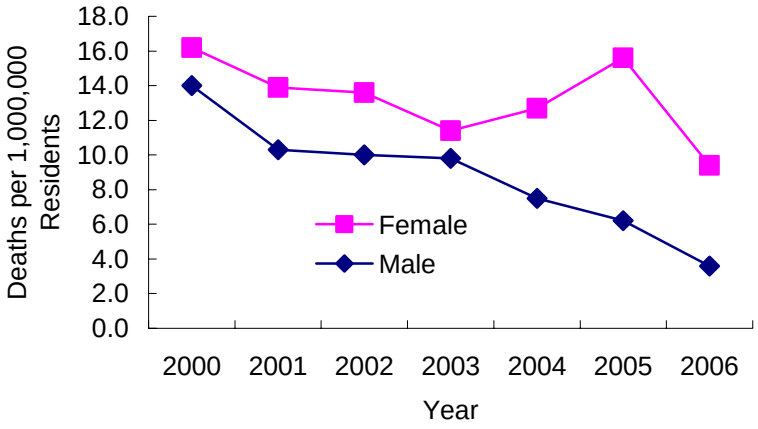


Age Group	No.	Rate[1]	95% CI [2]
0-11 years	4	0.8	0.2-2.1
12-17 years	7	2.7	1.1-5.6
18-34 years	34	4.6	3.2-6.4
35-64 years	132	10.1	8.4-11.8
65+ years	201	46.9	40.4-53.4

[1]Rate of deaths due to asthma per 1,000,000 residents.
[2] 95% Confidence Interval of the age-specific rate.
Data Source: CY2002-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

- The five-year average annual age-specific death rates due to asthma increased with increasing age group.
- The highest five-year average annual age-specific rate in Massachusetts was among adults ages 65+ years (46.9 per 1,000,000).
- From 2002 through 2006, almost half (47%) of the deaths due to asthma in Massachusetts were among individuals under 65 years of age (n=177 out of 378).

Figure 5.4: Age-adjusted Death Rates due to Asthma by Sex, 2000-2006
Massachusetts Residents

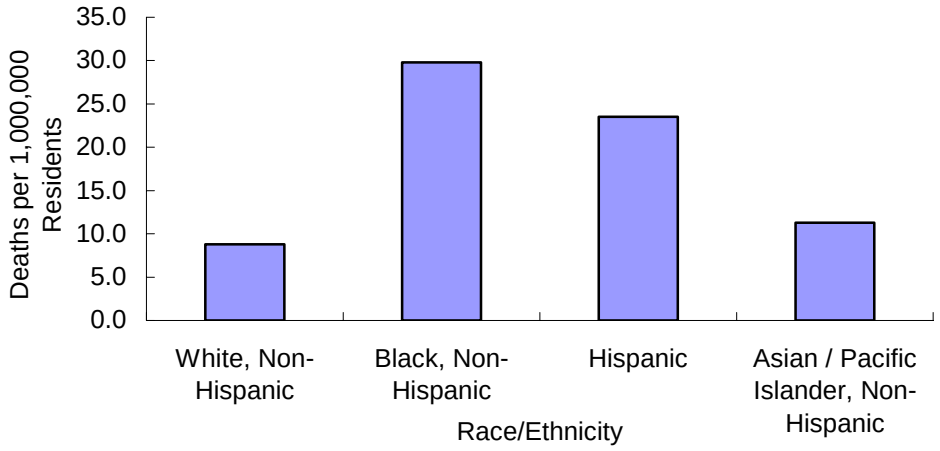


	Male				Female			
Year	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
2000	41	13.4	14.0	9.7 - 18.3	64	19.4	16.2	12.2 - 20.3
2001	30	9.7	10.3	6.6 - 14.1	54	16.3	13.9	10.2 - 17.7
2002	31	10.0	10.0	6.5 - 13.6	57	17.2	13.6	10.0 - 17.3
2003	29	9.3	9.8	6.2 - 13.4	45	13.5	11.4	8.0 - 14.8
2004	23	7.4	7.5	4.4 - 10.6	57	17.2	12.7	9.3 - 16.2
2005	19	6.1	6.2	3.4 - 9.0	65	19.6	15.6	11.7 - 19.5
2006	11	3.5	3.6	1.5 - 5.8	41	12.3	9.4	6.4 - 12.3

[1]Rate of deaths due to asthma per 1,000,000 residents.
[2]Age-adjusted to US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY2000-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

- From 2000 through 2006, the age-adjusted death rate due to asthma was higher among females than males, although the difference was only statistically significant in 2005 and 2006.
- From 2000 through 2006, the age-adjusted death rate among males decreased 74.3% from 14.0 to 3.6 per 1,000,000 residents (ρ=-0.964, p=0.0005). The age-adjusted death rate among females decreased 42.0%; this trend was not statistically significant (ρ=-0.607, p=0.148).

Figure 5.5: Five-year Average Annual Age-adjusted Death Rates due to Asthma by Race/Ethnicity, 2002-2006
Massachusetts Residents

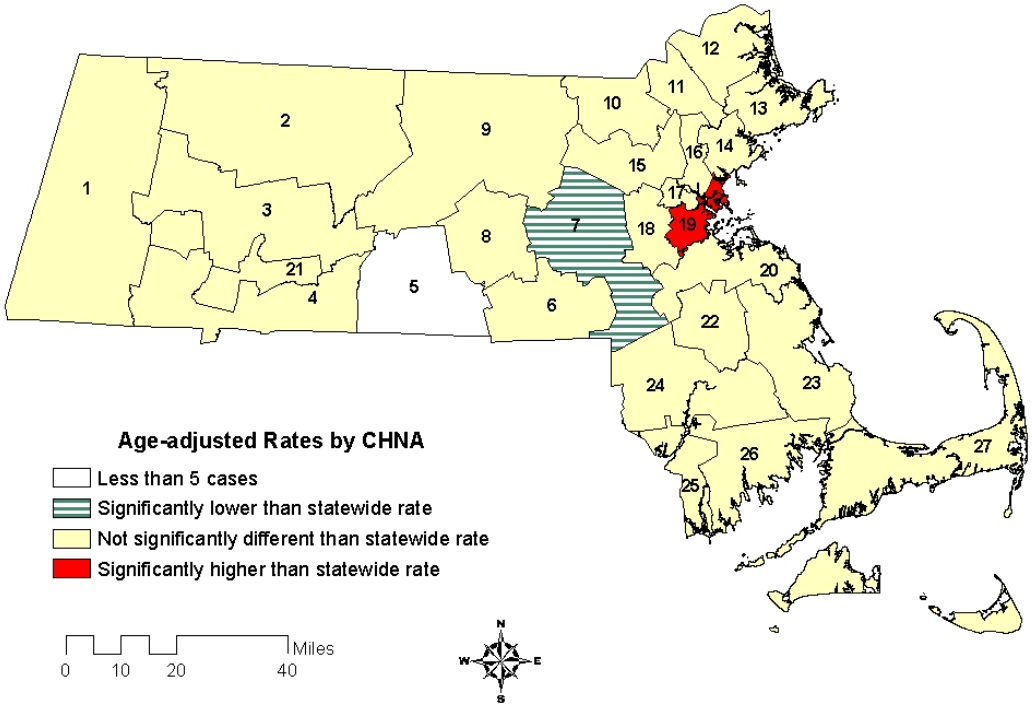


Race / Hispanic Ethnicity	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI [3]
White, non-Hispanic	290	11.1	8.8	7.8 - 9.9
Black, non-Hispanic	47	24.4	29.8	20.9 - 38.7
Hispanic	31	12.5	23.5	13.7 - 33.3
Asian / Pacific Islander, non-Hispanic	10	6.6	11.3	3.6 - 19.0
American Indian, non-Hispanic	0	0	--	--

[1]Rate of deaths due to asthma per 1,000,000 residents.
[2]Age-adjusted to US 2000 Population.
[3] 95% Confidence Interval of the age-adjusted rate.
Data Source: CY2002-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

- The five-year average annual age-adjusted death rate among Black, non-Hispanics was 3.4 times the rate among White, non-Hispanics.
- Similarly, the rate among Hispanics was 2.7 times the rate among White, non-Hispanics.

Map 5.1: Five-year Average Annual Age-adjusted Death Rates due to Asthma by Community Health Network Area (CHNA) of Residence, 2002-2006
Massachusetts Residents



Data Source: CY2002-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

- The five-year average annual age-adjusted death rate due to asthma in Massachusetts was 10.5 per 1,000,000 residents.
- The five-year average annual age-adjusted death rate was higher in CHNA 19: Alliance for Community Health (16.8 per 1,000,000) than the overall statewide rate.
- The five-year average annual age-adjusted death rate was lower in CHNA 7: Community Health Network of Greater Metro West (5.7 per 1,000,000) than the overall statewide rate.

Map 5.1 (continued): Five-year Average Annual Age-adjusted Death Rates due to Asthma by Community Health Network Area (CHNA) of Residence, 2002-2006
Massachusetts Residents

Community Health Network Area (CHNA)	No.	Crude rate[1]	Age-adjusted rate[2]	95% CI[3]
1. Community Health Network of Berkshire	8	12.1	8.2	2.3-14.1
2. Upper Valley Health Web (Franklin County)	7	15.9	16.7	4.2-29.2
3. Partnership for Health in Hampshire County (Northampton)	17	22.4	20.0	10.1-29.8
4. The Community Health Connection (Springfield)	29	19.5	17.8	11.2-24.3
5. Community Health Network of Southern Worcester County	4	--	--	--
6. Community Partners for Health (Milford)	6	7.6	7.3	1.4-13.1
7. Community Health Network of Greater Metro West (Framingham)	11	5.8	5.7	2.3-9.2
8. Common Pathways (Worcester)	18	11.9	10.3	5.5-15.1
9. Community Health Network of Central Massachusetts	10	7.7	7.5	2.8-12.1
10. Greater Lowell Community Health Network	10	7.3	8.1	3.1-13.2
11. Greater Lawrence Community Health Network	10	10.4	10.0	3.7-16.2
12. Greater Haverhill Community Health Network	6	8.1	7.7	1.5-14.0
13. Greater Beverly/ Gloucester Community Health Network	12	20.0	14.7	6.3-23.1
14. North Shore Community Health Network	23	16.1	13.9	8.2-19.7
15. Northwest Suburban Health Alliance	15	14.3	11.6	5.7-17.5
16. North Suburban Health Alliance (Medford/Malden/Melrose)	18	13.9	11.3	6.0-16.5
17. Greater Cambridge/Somerville Community Health Network	13	9.4	9.3	4.2-14.4
18. West Suburban Health Network (Newton/Waltham)	13	10.3	7.4	3.2-11.5
19. Alliance for Community Health (Boston/Chelsea/Revere/Winthrop)	57	15.7	16.8	12.4-21.3
20. Blue Hills Community Health Alliance (Quincy)	16	8.6	7.8	3.8-11.7
21. Community Health Network of Chicopee-Holyoke-Ludlow-Westfield	7	8.7	7.5	1.8-13.3
22. Greater Brockton Community Health Network	16	13.3	12.9	6.6-19.3
23. South Shore Community Health Network	6	6.4	6.1	1.2-11.0
24. Greater Attleboro-Taunton Health Education	14	11.1	11.0	5.2-16.8
25. Partners for Healthier Communities (Fall River)	7	9.8	7.9	2.0-13.9
26. Greater New Bedford Community Health Network	14	14.0	11.4	5.3-17.4
27. Cape Cod and Islands Community Health Network	11	8.7	6.4	2.3-10.4
Massachusetts Total	378	11.7	10.5	9.4-11.6

[1]Five-year average annual crude rate of deaths due to asthma per 1,000,000 residents.
[2]Five-year average annual age-adjusted rate of deaths due to asthma per 1,000,000 residents. Age-adjusted to the US 2000 Population.
[3]95% Confidence Interval of the age-adjusted rate.
Data Source: CY2002-2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health

Section 6. Healthy People 2010 Objectives

Sponsored by the US Department of Health and Human Services, the Healthy People 2010 initiative is a comprehensive set of disease prevention and health promotion objectives for the nation to achieve over the first decade of the new century.[35 37] Created by scientists both inside and outside of government, it identifies a wide range of public health priorities and specific, measurable objectives. It can be used by many different people, states, communities, professional organizations, and others to help them develop and evaluate programs to improve health.

As national benchmarks, the Healthy People 2010 objectives are used widely at the national, state, and community level. The targets for each asthma objective were chosen based on national baseline data and the pursuit of a "better than best" goal. In utilizing these objectives for asthma, Massachusetts can direct its efforts to achieving national goals, compare its asthma burden to others, and measure progress over time in achieving the objectives.

For more information about Healthy People 2010 initiatives, visit their website: http://www.healthypeople.gov.

Table 6.1: Comparing Massachusetts to the Healthy People 2010 Targets for Asthma

Objective	Age Group	Massachusetts	HP2010 Target
24-1 Reduce asthma deaths for asthma (rate per 1,000,000 residents)	< 5 years	0.0[1]	1.0
	5-14 years	0.0[1]	1.0
	15-34 years	2.3[1]	2.0
	35-64 years	6.4[1]	9.0
	≥ 65 years	36.0[1]	60.0
24-2 Reduce hospitalizations for asthma (rate per 10,000 residents)	< 5 years	34.8[2]	25.0
	5-64 years	10.4[2]	7.7[+]
	≥ 65 years	25.6[2]	11.0[+]
24-3 Reduce emergency department discharges for asthma (rate per 10,000 residents)	< 5 years	115.4[3]	80.0
	5-64 years	57.9[3]	50.0[+]
	≥ 65 years	18.0[3]	15.0[+]
24-4 Reduce activity limitations among persons with asthma	0-17 years	50.9%[4]	6%[+]
	≥18 years	62.5%[5]	
24-5 Reduce the number of school or work days missed by persons with asthma because of asthma (among individuals ages 5-64 years)	0-17 years	1.9 days[4]	2.0[+]
	≥18 years	6.1 days[5]	
24-6 Increase the proportion of persons with asthma who receive formal patient education	0-17 years	7.8%*[4]	30%[+]
	≥18 years	5.1%[5]	
24-7a Increase proportion of persons with asthma who receive written asthma management plans from health care provider.	0-17 years	45.0%[4]	38%[+]
	≥18 years	33.4%[5]	
24-7b Increase proportion of persons with asthma who receive instruction on how to use a prescribed inhaler properly.	0-17 years	97.2%[4]	98.8%[+]
	≥18 years	97.6%[5]	
24-7c Increase proportion of persons with asthma who received education about recognizing early signs & symptoms of asthma episodes, or how to respond appropriately to an asthma episode, or instruction on peak flow monitoring for those using daily therapy	0-17 years	95.0%[4]	71%[+]
	≥18 years	89.7%[5]	
24-7d Increase proportion of persons with asthma whose medication regimens prevent the need for more than 1 canister of short acting inhaled beta agonists per month for relief of symptoms	Not available	Not available	92%[+]
24-7e Increase proportion of persons with asthma follow-up medical care for long-term management after a hospitalization due to asthma.	Not available	Not available	87%[+]
24-7f Increase proportion of persons who receive assistance with assessing and reducing exposure to environmental risk factors.[†]	0-17 years	49.6%[4]	50%[+]
	≥18 years	46.5%[5]	

[+] Age adjusted to the 2000 US population.
*Relative Standard Error is > 30% therefore the results should be interpreted with caution due to the instability of the estimate.
[†]Proxy: A health care professional advised you to modify home, school or work environment to improve symptoms of asthma
[1] Data Source: CY2006 Massachusetts Registry of Vital Records and Statistics, Massachusetts Department of Public Health
[2] Data Source: CY2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy
[3] Data Source: CY2005 Massachusetts Emergency Department Discharge Database, Massachusetts Health Care Finance and Policy
[4] Data Source: 2006-2007 Massachusetts Child Asthma Call-back Survey, Massachusetts Department of Public Health
[5] Data Source: 2006-2007 Massachusetts Adult Asthma Call-back Survey, Massachusetts Department of Public Health

- Massachusetts is demonstrating progress towards meeting the following Healthy People 2010 targets for asthma:
    - Asthma mortality rates for all age groups.
    - Adults and children with asthma who received an asthma action plan.
    - Adults and children with asthma who received instruction on how to use a prescribed inhaler properly.

- Adults and children with asthma who were taught to recognize early signs of an asthma episode, how to respond to an asthma episode, or received instruction on peak flow monitoring.
- Adults and children with asthma who received assistance with assessing and reducing exposure to environmental risk factors.

Appendix A. Data Sources and Technical Notes

Data Sources

Deaths
Source: Registry of Vital Records and Statistics, Massachusetts Department of Public Health

From 1994 through 1998, an asthma death was defined as any death with an International Classification of Disease, Version 9 (ICD-9) code of 493 in the underlying cause field. In 1999, a new revision of the coding system was implemented for the coding of deaths, the International Classification of Disease, Version 10 (ICD-10). Since 1999, an asthma death was defined as any death with an ICD-10 code of J45.0-J45.9 in the underlying cause of death field.[38] Caution should be used in the interpretation of trends across these two coding systems as asthma categories classified using ICD-10 may not be comparable to asthma categories classified using ICD-9 in frequency or rates per population. The death data in this report are provided for the calendar year (January 1 – December 31) from 1994 through 2006. Massachusetts residents who died in or out-of-state are included in these analyses; out-of-state residents who died in Massachusetts are not included. Rates are reported per 1,000,000 residents.

Hospitalizations
Source: Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy

An asthma hospitalization was defined as any case having an International Classification of Disease, Ninth Revision for Clinical Modification (ICD-9-CM) diagnosis code of 493.0-493.9 assigned to the primary diagnosis field.[38] The inpatient hospital data in this report are for a calendar year (January 1 – December 31) from 1994 through 2006. Rates are reported per 10,000 residents. At-risk based rates of hospitalizations are per 100 persons with asthma. See below for additional data considerations.

Observation Stays
Source: Massachusetts Outpatient Observation Stays Database, Massachusetts Division of Health Care Finance and Policy

Observation stays are discharges from an observation bed of an acute care hospital in Massachusetts. These are generally short term (<24 hour) stays, although the criteria for observation stay admission varies across hospitals. An asthma observation stay was defined as any case having an International Classification of Disease, Ninth Revision for Clinical Modification (ICD-9-CM) diagnosis code of 493.0-493.9 assigned to the primary diagnosis field.[38] The observation stay data in this report are for a calendar year (January 1 – December 31) from 1998 through 2005. Rates are reported per 10,000 residents. See below for additional data considerations.

Emergency Department Discharges
Source: Massachusetts Emergency Department Discharge Database, Massachusetts Division of Health Care Finance and Policy

Emergency department (ED) visits are discharges from the emergency department of an acute care hospital in Massachusetts. An asthma emergency department discharge was defined as any case having an International Classification of Disease, Ninth Revision for Clinical Modification (ICD-9-CM) diagnosis code of 493.0-493.9 assigned to the primary diagnosis field.[38] The emergency department data in this report are for a calendar year (January 1 – December 31) from 2002 through 2005. Rates are reported per 10,000 residents. See below for additional data considerations.

Additional Data Considerations for Hospitalizations, Observation Stays and Emergency Department Discharge Databases

- The acute care hospital databases are mutually exclusive for single episodes of treatment within a particular hospital. For instance, if a person is treated at the emergency department of Hospital A, and then is admitted as an inpatient to Hospital A, the patient's data would only be reported by Hospital A to the state's inpatient hospitalization database, not to the state's emergency department database. However, the data for a patient transferred from the emergency department of Hospital A to the emergency department of Hospital B before being sent home will be reported by both Hospital A and Hospital B to the state's emergency department database.
- Any asthma case transferred to another acute care hospital or subsequently dying in the hospital, observation stay or emergency department were included in the analyses.
- All dispositions are included in the analyses.
- Massachusetts residency is based on the listed zip code of residence. Only cases having a valid Massachusetts zip code as defined by the MDPH's on-line query system (MassCHIP) are included in these analyses. Counts of asthma hospitalizations, observation stays or emergency department discharges by city/town or CHNA involving patients with zip codes that are shared across city and town borders were weighted using methodology described elsewhere.[39]
- Massachusetts residents receiving care for an asthma episode at an out-of-state hospital are not included in the acute care hospital totals.
- Other hospitals such as federal, psychiatric, rehabilitation, or specialty hospitals and outpatient clinics do not submit data to these databases.
- Fatal and nonfatal cases (upon discharge) were included when calculating rates.
- These are administrative databases which provide data on all inpatient hospital, observation stay, and emergency department discharges that occur within an acute care hospital in Massachusetts. The data are collected primarily for billing and other administrative purposes but are commonly used by states for public health surveillance.
- The counts and rates reported represent events of acute care hospital utilization and not the counts and rates of individual asthma episodes. The same person may be treated at the hospital multiple times for the same asthma episode or multiple asthma episodes.
- Data on race and ethnicity are limited by data quality issues.[40 41] Data collection of both race/ethnicity and city/town of residence are currently being improved by the Massachusetts Division of Health Care Finance and Policy.
- Three years of data were combined to produce a more stable estimate of the asthma rate for each Community Health Network Area (CHNA) in Massachusetts.
- Counts of hospital visits for an asthma episode by CHNA involving patients with zip codes that are shared across borders were weighted using methodology described elsewhere.[39]
- The financial charges of services are provided in both the hospital and emergency department data. The charges for service are based on the billing information as reported by the hospital to the source of payment, such as Medicaid. The charges for service are not reflective of the actual cost of the care, nor are they reflective of what was reimbursed to the hospital by the payer. Some of the charges may be for diagnostic conditions unrelated to asthma. The total direct charges do not include costs associated with the other effects of the asthma episode, such as lost time away from work or school or reduced quality of life.
- Hospital, observation stay and emergency department visit totals with fewer than 7 observations are suppressed. For all data sets, rates were not generated on counts less than 5. Trends based upon small numbers (<20) should be interpreted with caution as rates can fluctuate greatly from year to year with even a small change in the number of cases.

Massachusetts Behavioral Risk Factor Surveillance System
Source: Health Survey Program, Massachusetts Department of Public Health

The Behavioral Risk Factor Surveillance System (BRFSS) is a population-based random telephone survey and a commonly accepted source for information on a variety of health topics. The BRFSS collects uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic disease, injuries, and preventable infectious diseases in the adult and child populations. The BRFSS is the largest telephone health survey in the US, collecting data from more than 350,000 adults each year. The BRFSS is administered to adults ages 18 and above in all 50 states. State results can be compared with national estimates. BRFSS population estimates represent the prevalence of risk factors occurring among individuals living in the community. Up until 2006, the BRFSS was limited to

households with landline phones. Individuals who live in institutionalized settings, have cognitive limitations, do not have phone service or have only mobile phone service were unable to participate. BRFSS is based on self-reported data and as such are subject to the possible bias and errors associated with self-reported data. The 2007 response rate was 36%. The survey is administered in English, Spanish and Portuguese.

The underlying sample size (Sample Size) in the presented tables is the number of people who answered "yes" or "no" to the corresponding questions. The crude proportion (%) in the presented tables is a weighted ratio of those who answered "yes" to the corresponding questions versus all who responded to the question. These percentages are weighted to the total Massachusetts population for the corresponding year in order to reflect both the probability that an individual is selected to participate in the survey and differential participation by sex, age, and race/ethnicity. A detailed description of the weighting process has been published elsewhere.[42] BRFSS survey data and survey questions are in the public domain and may be reproduced without permission.[43] [44]

Definition of Lifetime and Current Asthma among Adults
For adults, lifetime asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the first question and current asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the second question.
1. Have you ever been told by a doctor, nurse, or health professional that you had asthma?
2. Do you still have asthma?

Definition of Lifetime and Current Asthma among Children
Since 2005, a random child selection module was added to the national and Massachusetts BRFSS survey. For children under age 18 years, the information is collected from an adult family member, usually a parent, who is knowledgeable about the child's health. Adult BRFSS respondents are asked how many children under age 18 live in their household; of all respondents reporting one or more children under age 18 living in the household, one child is selected using a computer-generated random selection process. The adult proxy is then asked various questions about the randomly-selected child. The adult proxy is not necessarily the parent or legal guardian of the child. Of the adult proxies reporting childhood data in 2007, 89.5% were a parent or legal guardian, 5.4% were grandparents, and the remaining 5.1% were an adult sibling, other adult relative, or non-related adult living in the child's household.

To obtain current asthma prevalence estimates for children, those adult proxies reporting that the randomly-selected child had ever received an asthma diagnosis were then asked if the randomly selected child still has asthma. Starting in 2005, the MA BRFSS survey included two questions on asthma prevalence among children.
1. Has a doctor, nurse, or health professional ever said that the child had asthma?
2. Does the child still have asthma?

For children, lifetime asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the first question and current asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the second question.

Massachusetts Asthma Call-back Survey (Adult and Child)
Source: Health Survey Program, Massachusetts Department of Public Health

The asthma call-back survey is a standardized questionnaire on asthma developed by the Centers for Disease Control and Prevention, administered on the telephone.[45] The survey examines the health, socioeconomic, behavioral and environmental predictors that relate to better control of asthma. It also is used to characterize the type of care and health care experiences of people with asthma. The data are available in Massachusetts beginning in 2006.

Respondents to the BRFSS who reported that they or the selected child in their household has ever been diagnosed with asthma were asked at the end of the BRFSS interview if they would be willing to participate in a follow-up interview on asthma. Respondents who agreed to participate were called back within 2 weeks and administered the survey. Adult proxies include parents, legal guardian, grandparents,

adult siblings, other relatives or other non-related adults living in the selected child's household. For more information on the call-back methodology, visit the CDC's website.[45]

Topics covered on the ACS include:
- History of asthma symptoms
- Health care utilization
- Asthma education
- Modifications to the environment
- Medications
- Access to care
- School, daycare, and workplace
- Co-morbid conditions
- Complimentary and alternative therapy

To view the complete survey for both children and adults, visit the CDC's website.[45]

A combined total of 624 adults (ages 18 years and older) and 169 adult proxies of children with asthma (ages 0-17 years) participated in the 2006-2007 call-back. Among them, 453 adults and 113 children were classified as having current asthma. Because of the relatively small number of children included in this survey, the 95% confidence intervals for the reported percentages are wide (i.e. the estimates are not as precise as those for the adults). The underlying sample size (Sample Size) in the presented tables is the number of people with current asthma who answered the corresponding questions or whose response was assumed based on an answer to a previous question. The crude proportion (%) in the presented tables is a weighted ratio of those who answered "yes" to the corresponding questions versus all who responded to the question. These percentages are designed to be representative of all Massachusetts adults and children with asthma.

Call-back data are based on self-reported information from respondents and therefore may be subject to error for several reasons: individuals may have difficultly remembering past events; individuals may respond differently to questions depending on what they perceive to be the socially desirable answer; and individuals may also respond to survey questions differently due to their respective cultural and linguistic backgrounds. The call-back survey is administered only to individuals with landline telephones and can be conducted in English or Spanish only. Therefore, individuals who do not speak one of these two languages and individuals living in households without landline telephones are not included in the sample, and BRFSS results may not be generalizable to these populations. For 2006 and 2007, an estimated 39.1% of eligible MA adults participated in the call-back survey. These low response rates may lead to non-response bias. In order to partially adjust for differential non-response, all data were weighted to represent the MA population and reflect both the probability that an individual is selected to participate in the survey and differential participation by age, gender, and, in 2007, race/ethnicity.

Definition of Asthma Control for Adults and Children with Current Asthma (all ages)
Several questions are used to measure the impairment construct of asthma control from the ACS (see footnotes below table). These questions are summarized into four main categories based on the EPR-3 Guidelines: symptoms (frequency and duration), nighttime awakenings, use of short-acting beta agonists (SABA), and interference with normal activities.[11] Control status was based on the most severe level across the three categories. It is important to note that lung function measures (FEV1 and PEF) are not available from the ACS and therefore, are not included in the classification of asthma control in this report.

Cut points were derived by assuming "the past 30 days" refers to 1 month with 4 weeks and were modified to meet the EPR-3 Guidelines where possible. For example, the ACS measures the number of days the respondent had symptoms in the past 30 days. Using the EPR-3 Guidelines, symptoms are classified as well controlled if they occur ≤2 days per *week*. Using the ACS, ≤2 days per week * 4 weeks is approximately 8 days/month (x/7 = 8/30, x=1.86). Therefore, the cut point for "well controlled" symptoms includes symptoms reported occurring on 8 days or less in the past 30 days.

The EPR-3 Guidelines for assessing asthma control are slightly different for children ages 0-4 years and 5-11 years. For the purpose of this report, the classification of asthma control for patients ages 12 years and older (see grid below) were also applied for children ages 0-4 and 5-11 years.

Classification of Asthma Control for Adults and Children

Variable	Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms[1]	$0 \leq x \leq 8$ days in the past 30 days	$9 \leq x \leq 29$ days in the past 30 days, or x= 30 days in the past 30 days but not throughout the day	x= 30 days in the past 30 days, and throughout the day
Nighttime Awakenings[2]	$0 \leq x \leq 2$ nights in the past 30 days	$3 \leq x \geq 12$ nights in the past 30 days	$13 \leq x \geq 30$ nights in the past 30 days
Inhaled SABA Use (uses per day)[3]	No prescription asthma medication with an inhaler use in the past 3 months, or no inhaled SABA medication use in the past 3 months, or total inhaled SABA medication use $\leq$ 0.29x per day.	0.29 <Total inhaled SABA medication use $\leq$ 1.00x per day	Total inhaled SABA medication use $\geq$ 1.00x per day
Interference with Normal Activity[4]	Not at all, or no symptoms past year	A little, or a moderate amount	A lot

[1] "During the past 30 days, on how many days did you have any symptoms of asthma?", "Do you have symptoms all the time?"
[2] "During the past 30 days, on how many days did symptoms of asthma make it difficult for you to stay asleep?"
[3] "In the past 3 months, have you taken prescription asthma medications using an inhaler?", "In the past 3 months, what prescription asthma medications did you take by inhaler?", "How many times per day or per week do you use [list of medications]?"
[4] During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?"

Definition of Work-related Asthma (Adult only)

Seven questions pertaining to asthma and the work environment were asked of ACS respondents who had ever worked. In other words, these questions were asked of respondents who reported either being currently employed or having ever worked outside the home, despite being currently unemployed. The following work-related asthma questions included:

1. Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?
2. Did you ever tell a doctor or other health professional that your asthma was related to any job you ever had?
3. Was your asthma caused by chemicals, smoke, fumes or dust in your current job?
4. Is your asthma made worse by chemicals, smoke, fumes or dust in your current job?
5. Was your asthma caused by chemicals, smoke, fumes or dust in any previous job you ever had?
6. Was your asthma made worse by chemicals, smoke, fumes or dust in any previous job you ever had?
7. Did you ever change or quit a job because chemicals, smoke, fumes or dust caused your asthma or made your asthma worse?

Respondents' answers to questions 1-6 allow for an assessment of the proportion of adult asthma that is associated with workplace exposures (PAAW). A "yes" answer to question 1 or 2 limits the definition of work-related asthma to discussions between patients and healthcare providers about the connection between asthma symptoms and work (WRA-HP). Alternatively, a "yes" answer to question 3-6 indicates a respondent's self-assessment that his/her asthma is related to work (WRA-SA). A "yes" answer to question 7 estimates how many people suffer work-related asthma symptoms severe enough to leave or

quit a job. In table 3.4, "work-relatedness" was defined as 'yes' to any of the 7 work-related asthma questions. A detailed description of the methodology used in this report to assess work-related asthma has been published elsewhere.[32]

Massachusetts SENSOR (Sentinel Event Notification System for Occupational Risk)
Source: Occupational Health Surveillance Program, Massachusetts Department of Public Health

Cases of work-related asthma (WRA) are sentinel health events that indicate the need for preventive intervention. From 1993 -2006, WRA sentinel cases were ascertained primarily by health care provider reports and from review of hospital records, including emergency department records. Cases are confirmed by telephone interviews, which allow confirmation of the case, collection of additional information about exposures and case classification. Work-related asthma may be characterized as Work-Aggravated Asthma or New-Onset Asthma. Reactive Airways Dysfunction Syndrome (RADS) is a subset of New-Onset Asthma, distinguished by persistent asthma symptoms caused by a one-time high level irritant exposure. Additional details of the SENSOR sentinel surveillance process, as conducted in California, Michigan and New Jersey, as well as Massachusetts, have been described in detail in previously published reports.[46] [47]

Work-Related Asthma Surveillance Categories

1. Work-aggravated asthma
2. New-onset asthma
    a. Occupational asthma (caused by sensitizers or irritants in the workplace)
    b. Reactive Airways Dysfunction Syndrome (RADS)

Pediatric Asthma Surveillance
Source: Epidemiology Unit in the Bureau of Environmental Health, Massachusetts Department of Public Health[24]

Generally asthma surveillance for a given school year begins in January/February when the MDPH/BEH requests all public, private, and charter schools in Massachusetts with any grade Kindergarten through 8 (approximately 2,100) to report the number of students with asthma enrolled in the school. Public school nurses and private school health contacts are mailed a one-page reporting form asking for aggregate numbers of children with asthma by grade, gender, and school building. Beginning in 2006-2007, the community (city/town) of residence for children with asthma is also requested. The school's name, address and Massachusetts Department of Education (DOE) school code are pre-printed on each form to facilitate completion of the form. In addition, an instruction sheet for completing the form is provided. The reporting forms are sent via the U.S. Postal Service. School nurses are asked to complete the form and fax or in some cases mail to the MDPH. Reminder post cards are sent to non-responding schools in April. Follow-up telephone calls are placed to nurses who do not respond by May. School enrollment data is submitted by the DOE. Schools that do not return a complete surveillance form or for which enrollment data could not be obtained by July are considered non-responsive and not included in the analysis.

MDPH/BEH staff review the surveillance forms for completeness and accuracy, and attempt to resolve missing data or inconsistencies. Massachusetts DOE school identifier codes are assigned to each school's surveillance form. Most surveillance forms are returned by fax. Once cleaned, the data is entered into a text file and then imported into an Access database.

A specific clinical definition of asthma is not provided to nurses or administrative staff. Instead, school nurse and administrative staff are asked to report the numbers of students known to have a diagnosis of asthma. This broad based definition captures asthma of all types. School nurses seek asthma information from the child's health record, emergency cards, physical exam forms, parent resource centers, parent communications, student communications, health care provider documentation, or direct observation of an asthma attack.

Essential School Health Services
Source: Essential School Health Services Program, Massachusetts Department of Public Health

School nurses who work in districts participating in the Essential School Health Services program provide data to the state on the number of students in their schools who receive health care services, the number of students with special health care needs, and the number and types of health care services provided. Through the ESHS data reports, nurses report the number of students whose school health records indicate they have asthma. These records are based on health examinations completed by the student's health care provider. Under state regulations, these examinations must be completed at least once every three to four years. Information from these exams is supplemented by health information and emergency card forms submitted by parents. Nurses also keep track of the number of doses of asthma medications that students take under nurse supervision during the school day, as well as the number of asthma prescriptions on file. To facilitate record-keeping, nurses use practice management software designed for use in school health offices. Medication administrations are tabulated at each district, and summary statistics are provided to the state on a monthly basis.

For the 2007-2008 school year, there were 102 districts participating in the ESHS program, with a total enrollment of 527,492 students (55% of the state's public school enrollment). ESHS asthma data may differ from other state prevalence data for a number of reasons: 1) the ESHS enrollment is not representative of the state, as African Americans, Hispanics, and low income students are over-represented in the ESHS population, 2) information obtained from nurse's records (and based on reports from health care providers) may differ from that provided by survey data, which is self-reported or informant-reported. An additional consideration is that ESHS medication reports do not include data from students (particularly older students) who self-administer without the knowledge of the school nurse. In addition, students who take medications at home are less likely to report their medications to the school nurse. In contract, medications taken on an "as needed" basis for asthma attacks are more likely to be reported to the school nurse because of the potential need for administration during the school day. Additional details of the data collection methods in the ESHS have been described in detail in previously published reports.[29]

Youth Health Survey

Source: Office of Data Analytics and Decision Support, Massachusetts Department of Public Health[25]

The Massachusetts Youth Health Survey (YHS) is the Massachusetts Department of Public Health's (MDPH) surveillance project to assess the health of public school students in grades 6 through 12. It is conducted every other year by the MDPH in collaboration with the Massachusetts Department of Elementary and Secondary Education (ESE). In each randomly selected school facility, the survey is administered to approximately 3 high school classrooms and 2 middle school classrooms. The hour long survey contains questions regarding health status, risk behaviors, and protective factors. In 2007, chronic conditions such as asthma were assessed with the following prompt, "Has a doctor or other health professional told you that you have any of the following health concerns?" The percentage of students who responded "Yes" to asthma as a health concern is weighted to provide a population based estimate of lifetime prevalence of asthma among Massachusetts high school and middle school students.

The YHS survey instrument and methodology is available from the Massachusetts Department of Public Health, Office of Statistics and Evaluation.

MassHealth Health Plan and Employer Data and Information Set (HEDIS)

MassHealth HEDIS is a set of performance measures for assessing, reporting on, and improving the quality of care provided by the five health plans serving the MassHealth managed care population (Boston Medical Center HealthNet Plan, Fallon Community Health Plan, Neighborhood Health Plan, Network Health and the Primary Care Clinician Plan). Managed care plan members who are 5 to 56 years and were continuously enrolled in a Medicaid managed care plan in 2008 were included in the analysis. HEDIS includes a quality of care measure for asthma called 'Use of Appropriate Medications for People with Asthma'. This measure evaluates whether members with persistent asthma are prescribed medications that are acceptable as primary therapy for long-term asthma control according to the National Heart, Lung, and Blood Institute's (NHLBI) *Guidelines for the Diagnosis and Management of Asthma.* The guidelines were first issued in 1991 and updated in 1997, 2002, and 2006. It is calculated as the percentage of people with persistent asthma who had at least one prescription for appropriate long-term asthma therapy. Persistent asthma is defined according to HEDIS specifications: in the year of the prevalence measurement year having 1) $\geq$4 asthma medication dispensing events OR 2) $\geq$1

emergency department visit for asthma OR 3) ≥1 hospitalization for asthma OR 4) ≥4 outpatient visits for asthma and >2 asthma medication dispensing events. To meet the HEDIS criteria for use of appropriate asthma medications, a managed care enrollee with persistent asthma would only need to have filled one prescription for a long-term asthma medication in a year. This measure is derived from health care utilization claims data collected at the state level.

The specifications are defined by the National Committee for Quality Assurance. The specifications are presented in the following document:

> Use of Appropriate Medications for People with Asthma. HEDIS 2003, Volume 3: Technical Specifications. Washington, DC; 2003.

Healthy People 2010 Objectives

Healthy People 2010: National Health Promotion and Disease Prevention Objectives is a national agenda that aims to significantly improve the health of Americans in the decade preceding the year 2010. Developed through an extensive governmental, professional, and public national process, Healthy People 2010 defined two broad national goals: to increase quality and years of healthy life and to eliminate health disparities. These goals were supported by 476 specific objectives that set priorities for public health during the first decade of the 2000's. The objectives were organized into 28 priority areas and for each objective, a numeric national target for the year 2010 was set. For each health status indicator in this report that has a corresponding Healthy People 2010 Objective, the year 2010 target is shown in the summary table in Section 6.

In presenting the Massachusetts data comparable to the Healthy People 2010 targets, methods from the National Center for Health Statistics (NCHS) were used. Methods for the Healthy People 2010 specifications are available from the following website: http://wonder.cdc.gov/data2010/focusod.htm.

Population Data

Population data were used to calculate age-adjusted and crude rates in Massachusetts.
Source: National Center for Health Statistics. Estimates of the July 1, 2000-July 1, 2006, United States resident population from the Vintage 2006 postcensal series by year, county, age, sex, race, and Hispanic origin, prepared under a collaborative arrangement with the U.S. Census Bureau. Available on the Internet from:
http://www.cdc.gov/nchs/about/major/dvs/popbridge/popbridge.htm . August 16, 2006.

2005 Massachusetts Population Estimates.

Age Group (Years)	Males	Females	Total
0-4	200,160	191,533	391,693
5-11	282,945	270,278	553,223
12-17	265,369	252,884	518,253
18-24	311,747	314,161	625,908
25-34	417,787	420,712	838,499
35-44	497,064	513,435	1,010,499
45-54	466,310	492,143	958,453
55-64	325,364	355,177	680,541
65+	347,109	509,189	856,298

The three-year average annual age-adjusted rates of emergency department discharges, observation stays, and hospitalizations due to asthma by Community Health Network Area used population estimates from 2005 MassCHIP Population Estimates, multiplied by 3.

Statistical Testing

To determine if the prevalence of asthma, hospital treatment or deaths due to asthma follow an increasing or decreasing trend over time, the Spearman Correlation Coefficient and its accompanying statistical Rank Correlation Test were utilized to test whether there is a statistically significant relationship between 2 variables, in this case, year and rate.

For comparisons of more than 100 events, whether they are rates or proportions, within the same time period, the binomial distribution is assumed and confidence intervals are examined to see whether they overlap. When the number of events is less than 100, a Poisson distribution is assumed, and confidence intervals are constructed based upon the Poisson distribution. For more details and exact formulas for calculating confidence intervals or other tests of statistical significance, refer to the following publication from the National Center for Health Statistics (NCHS):

National Vital Statistics Reports, Volume 52, Number 10
Births: Final Data for 2002
By Joyce A. Martin, MPH, Brady E. Hamilton, PhD, Paul D. Sutton, PhD, Stephanie J. Ventura, MA, Fay Menacker, DrPH, and Martha L. Munson, MS
From the Division of Vital Statistics, NCHS.
Technical Notes, "Significance testing" section beginning on page 110.

This document is available from the following website:
http://www.cdc.gov/nchs/products/pubs/pubd/nvsr/52/52-23.htm

Prevalence: the proportion of individuals in a population who have the disease at a point in time. It is calculated as follows:

$$\text{Prevalence} = \frac{\text{Number of existing cases with the disease}}{\text{Total population}}$$

Crude Rate: represents the "true" number of occurrences of a health event in a specified time and population per unit time. It is calculated as follows:

$$\text{Crude Rate} = \frac{\text{\# of residents with asthma event in a year}}{\text{Resident population for that year}} \times 10{,}000$$

Age-adjusted Rate: a summary rate designed to minimize the distortions created by differences in age distribution when comparing rates for populations with different age compositions. Age-adjusted rates are useful when comparing death rates from different populations or in the same population over time. For example, if one wants to compare the 1998 death rates between Barnstable County (Cape Cod) and Hampshire County, the age-adjusted formula would account for the fact that 24% of the Barnstable County residents were 65 years of age or older, whereas only 11% of the Hampshire County residents were in this age group. Age-adjusted rates in this report were calculated by weighting the age-specific rates for a given year to the 2000 US standard population.[48] It is calculated as follows:

Age Group (Years)	State Population	Number of cases in State	State Age-Specific Rate	Weight	Weighted State Age-Specific Rate
65-69	pop1	n1	n1/pop1	0.271103	(n1/pop1) * 0.271103
70-74	pop2	n2	n2/pop2	0.251397	(n2/pop2) * 0.251397
75-79	pop3	n3	n3/pop3	0.213627	(n3/pop3) * 0.213627
80-84	pop4	n4	n4/pop4	0.14117	(n4/pop4) * 0.14117
85+	pop5	n5	n5/pop5	0.122702	(n5/pop5) * 0.122702
Total	pop6	n6	--	1	SUM of column = State Age-Adjusted Rate

Age-specific Rate: a rate for a specific age group is calculated by dividing the actual number of cases in a given year for a specific age group by the population in that age group for that year. The numerator

(number of cases) and the denominator (population) refer to the same age group. It is calculated as follows:

$$\text{Age-specific Rate} = \frac{\text{\# of residents with asthma event ages 5-11 in a given year}}{\text{Resident population ages 5-11 in that year}} \times 10{,}000$$

At-risk Based Rate (for hospitalizations): The number of hospitalization events due to asthma divided by the number of people with asthma in Massachusetts.[36]

Confidence Intervals: Since all data provided in these tables are estimates, there is some margin of error associated with these estimates; confidence intervals give a measure of how large that margin of error is. In each table, the percentages are accompanied by 95% confidence intervals; this means that the true value of the measure falls within the range given by the confidence interval 95% of the time. The difference between two groups is statistically significant if the 95% confidence intervals surrounding these two estimates do not overlap.

Confidence intervals can also help determine whether a difference between two groups is statistically significant. For example, if the asthma prevalence in town A is 8.3% (95% CI: 7.4-9.2%) and the prevalence in town B is 9.8% (95% CI: 9.5-10.1%), the difference in asthma prevalence between towns A and B is statistically significant because the two confidence intervals do not overlap. However, if town C has an asthma prevalence of 9.8% (95% CI: 8.8-10.8%), the difference in asthma prevalence between towns A and C is not statistically significant because these two confidence intervals do overlap. This example shows that even if two towns have the same estimated asthma prevalence (both B and C have an estimated prevalence of 9.8%), it is the confidence interval surrounding these estimates that determines a statistically significant difference with the estimated asthma prevalence of town A.

Rate of Change: The total rate of change is calculated as follows:

$$\frac{P_n - P_o}{P_o}$$

Where P_n is the rate during the later time period and P_o is the rate during the earlier time period.

Spearman Correlation Coefficient: The Spearman Correlation Coefficient (rho, ρ) ranges from -1.0 to 1.0. If the coefficient equals -1.0, it indicates a perfect negative correlation, where each year has a lower hospitalization rate than the previous year. If the coefficient equals 1.0, it indicates a perfect positive correlation, where each year has a higher hospitalization rate than the previous year. As the correlation coefficient approaches 0.0 from either direction, the relationship between the 2 variables weakens. For example, a correlation coefficient of 0.90 indicates a stronger positive relationship between 2 variables than a coefficient of 0.50.

Rank Correlation Test: The p-value of the Rank Correlation test ranges from 0.0 to 1.0 and gives the probability of finding a significant overall trend in the asthma data when, in reality, no trend exists. The standard used to assess the significance of a statistical test is p-value=0.05. A p value less than or equal to 0.05 indicates that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable. In this case, the result is considered statistically significant. If the p value is greater than 0.05, chance cannot be excluded as a likely explanation for the observed trend, so the result is not considered statistically significant.

Based on the Spearman Correlation Coefficient and the p-value of the Rank Correlation test,

- If there is a statistically significant **increase** in asthma hospitalization rates, for example, over time, the Spearman Correlation Coefficient will be **positive** and the p-value for the test will be **less** than 0.05
- If there is a statistically significant **decrease** in asthma hospitalization rates over time, the Spearman Correlation Coefficient will be **negative** and the p-value for the test will be **less** than 0.05.

Relative Standard Error: The standard error of the estimate is a measure of its variability. Bigger standard errors yield wider confidence intervals and less reliable estimates.

Appendix B. Supplemental Data Tables

Section 1. Prevalence of Asthma among Adults and Children

Supplemental data to Figure 1.2: Trend in Prevalence of Lifetime Asthma among Adults by Gender, 2000-2007

Massachusetts Respondents

	Male			Female		
Year	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
2000	3,223	10.2	8.9-11.5	4,916	13.4	12.2-14.6
2001	3,554	11.0	9.7-12.2	5,060	14.9	13.7-16.2
2002	2,988	11.3	9.8-12.8	4,429	14.3	13.0-15.6
2003	3,022	13.0	11.4-14.6	4,547	15.6	14.2-17.0
2004	3,211	11.8	10.3-13.3	4,971	17.7	16.3-19.1
2005	3,405	11.4	9.9-12.8	5,484	16.7	15.2-18.1
2006	4,748	12.9	11.3-14.5	7,944	16.0	14.8-17.2
2007	7,587	13.0	11.7-14.2	13,862	17.6	16.6-18.6

[1] Sample size is the number of respondents who answered the corresponding question.
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2000-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

Supplemental data to Figure 1.4: Trend in Prevalence of Current Asthma among Adults by Age Group, 2000-2007

Massachusetts Respondents

	18-24 years			25-34 years			35-44 years		
Year	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
2000	704	10.6	7.9-13.3	1,711	8.3	6.8-9.8	1,903	8.4	6.9-9.9
2001	661	13.7	10.4-17.0	1,720	9.8	8.1-11.5	1,981	10.0	8.3-11.7
2002	556	12.7	9.1-16.3	1,373	9.8	7.7-11.9	1,644	8.1	6.4-9.8
2003	497	12.9	9.3-16.5	1,419	10.8	8.8-12.8	1,638	9.5	7.6-11.4
2004	445	12.5	8.8-16.2	1,254	9.3	7.3-11.3	1,668	9.4	7.7-11.1
2005	407	11.1	6.9-15.3	1,207	11.3	9.0-13.6	1,789	9.0	7.3-10.7
2006	501	12.6	8.3-16.9	1,515	10.5	8.2-12.8	2,490	9.4	7.9-10.9
2007	755	10.7	7.6-13.8	2,085	11.4	9.2-13.6	3,581	9.6	8.4-10.8

	45-54 years			55-64 years			65+ years		
Year	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]	Sample Size[1]	%[2]	95% CI[3]
2000	1,455	9.3	7.5-11.1	926	9.4	7.3-11.5	1,364	5.9	4.5-7.3
2001	1,649	8.5	6.8-10.2	1,008	9.0	7.0-11.0	1,468	6.8	5.3-8.3
2002	1,429	9.5	7.7-11.3	920	8.7	6.7-10.7	1,407	6.0	4.5-7.5
2003	1,460	10.4	8.5-12.3	1,053	9.1	7.0-11.2	1,375	7.7	6.0-9.4
2004	1,745	9.3	7.7-10.9	1,345	10.0	8.0-12.0	1,630	8.5	6.8-10.2
2005	1,871	9.2	7.6-10.8	1,567	10.4	8.4-12.4	1,890	7.6	6.0-9.2
2006	2,558	10.0	8.5-11.5	2,296	10.3	8.7-11.9	3,125	7.4	6.2-8.6
2007	4,181	10.0	8.8-11.2	4,170	9.7	8.5-10.9	6,386	8.5	7.5-9.5

[1] Sample size is the number of respondents who answered the corresponding question.
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2000-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

Supplemental data table to Figure 1.6: 2007 Massachusetts and US Population Profile of Select Demographic and Social Characteristics

	Massachusetts		United States
Measure	Population Estimate	% of Population	% of Population
Total[1]	6,449,755	100.0%	
% with Less Than a High School Diploma (ages 25+ years) [2]	507,205 (± 13,187)	11.6%	15.5%
% In Poverty[2]	638,526*	9.9%	13.0%
Male[1]	3,126,493	48.5%	49.3%
White, non-Hispanic[1]	5,180,383	80.3%	66.7%
Black, non-Hispanic[1]	401,155	6.2%	12.6%
Asian, non-Hispanic[1]	324,858	5.0%	4.7%
American Indian, non-Hispanic[1]	15,500	0.0%	0.8%
Hispanic[1]	527,859	8.2%	15.1%

Among Hispanics	Population Estimate	% of Hispanic Total	% of Hispanic Total
Puerto Rican[2]	232,275	44.10%	9.1%
Dominican (Dominican Republic)[2]	83,758	15.90%	2.7%
Mexican[2]	38,098	7.20%	64.2%

[1]2007 National Center for Health Statistics Modified Age Race Sex (MARS) Estimates.
[2] 2007 American Community Survey 1-year Estimates, Survey: American Community Survey, Geographic Area: Massachusetts.
*Note: This estimated count is based on the ACS estimate of 9.9%.

Supplemental data table to Figure 1.10: Prevalence of Current Asthma among Adults by Smoking Status, 2000-2007
Massachusetts Respondents

	Current Smoker			Former Smoker			Never Smoker		
Year	Sample Size[1]	%	95% CI [3]	Sample Size[1]	%	95% CI [3]	Sample Size[1]	%	95% CI [3]
2000	201	11.5	9.6-13.4	195	8.6	7.2-10.0	338	7.2	6.3-8.2
2001	203	11.3	9.3-13.4	236	9.2	7.8-10.6	379	8.9	7.9-10.0
2002	160	10.2	8.0-12.5	210	8.9	7.4-10.3	306	8.5	7.3-9.6
2003	176	11.7	9.5-13.9	241	10.1	8.6-11.6	347	9.2	8.0-10.4
2004	221	13.4	10.9-15.9	256	9.3	7.9-10.7	402	8.6	7.5-9.7
2005	244	12.0	9.5-14.5	280	10.0	8.4-11.5	410	8.7	7.6-9.9
2006	332	14.1	11.3-17.0	419	9.0	7.8-10.2	639	8.9	7.8-9.9
2007	493	12.5	10.6-14.4	756	9.7	8.7-10.6	991	9.2	8.3-10.1

[1] Sample size is the number of respondents who answered the corresponding question.
[2] Percents are weighted to population characteristics.
[3] 95% Confidence Interval.
Data Source: 2000-2007 Massachusetts Behavioral Risk Factor Surveillance System, Massachusetts Department of Public Health

Map 1.2 (corresponding data table): Prevalence of Lifetime† Asthma among Massachusetts Elementary and Middle School Children by Community of Residence, 2006-2007 School Year
Massachusetts Students in Grades Kindergarten through 8th

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
ABINGTON	9.4	8.03	10.77	Statistically Significantly Lower
ACTON*	8.8	7.85	9.75	Statistically Significantly Lower
ACUSHNET	6.63	5.20	8.06	Statistically Significantly Lower
ADAMS	11.58	9.52	13.64	Not Statistically Significantly Different
AGAWAM	8.67	7.68	9.66	Statistically Significantly Lower
ALFORD	13.04	0.00	26.81	Not Statistically Significantly Different
AMESBURY	7.63	6.40	8.86	Statistically Significantly Lower
AMHERST*	12.31	10.86	13.77	Not Statistically Significantly Different
ANDOVER	11.75	10.77	12.72	Not Statistically Significantly Different
ARLINGTON	7.42	6.59	8.25	Statistically Significantly Lower
ASHBURNHAM	10.78	8.60	12.96	Not Statistically Significantly Different
ASHBY	5.87	3.64	8.10	Statistically Significantly Lower
ASHFIELD	13.4	8.61	18.20	Not Statistically Significantly Different
ASHLAND	6.76	5.67	7.86	Statistically Significantly Lower
ATHOL	15.34	13.48	17.21	Statistically Significantly Higher
ATTLEBORO	12.33	11.38	13.27	Statistically Significantly Higher
AUBURN	10.79	9.34	12.25	Not Statistically Significantly Different
AVON	9.36	6.63	12.09	Not Statistically Significantly Different
AYER	12.77	10.37	15.17	Not Statistically Significantly Different
BARNSTABLE	6.22	5.51	6.94	Statistically Significantly Lower
BARRE	7.99	5.94	10.03	Statistically Significantly Lower
BECKET	7.61	3.78	11.44	Not Statistically Significantly Different
BEDFORD	10.27	8.76	11.78	Not Statistically Significantly Different
BELCHERTOWN	8.58	7.33	9.83	Statistically Significantly Lower
BELLINGHAM	7.94	6.72	9.17	Statistically Significantly Lower
BELMONT	8.09	6.79	9.39	Statistically Significantly Lower
BERKLEY	5.97	4.48	7.46	Statistically Significantly Lower
BERLIN*	7.42	4.50	10.34	Statistically Significantly Lower
BERNARDSTON	8.92	5.09	12.75	Not Statistically Significantly Different
BEVERLY	9.8	8.84	10.76	Statistically Significantly Lower
BILLERICA	8.7	7.90	9.50	Statistically Significantly Lower
BLACKSTONE	9.8	7.99	11.60	Not Statistically Significantly Different
BLANDFORD	8.7	3.99	13.40	Not Statistically Significantly Different
BOLTON	7.05	5.27	8.83	Statistically Significantly Lower
BOSTON	14.14	13.83	14.45	Statistically Significantly Higher
BOURNE	10.06	8.72	11.40	Not Statistically Significantly Different
BOXBOROUGH*	5.45	3.85	7.06	Statistically Significantly Lower
BOXFORD*	7.52	6.10	8.95	Statistically Significantly Lower
BOYLSTON	3.66	0.79	6.53	Statistically Significantly Lower
BRAINTREE	12.58	11.54	13.62	Statistically Significantly Higher
BREWSTER*	9.2	7.22	11.19	Not Statistically Significantly Different
BRIDGEWATER	10.05	8.97	11.13	Not Statistically Significantly Different
BRIMFIELD	15.8	12.33	19.27	Statistically Significantly Higher
BROCKTON	15.07	14.42	15.72	Statistically Significantly Higher

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
BROOKFIELD	13.03	9.52	16.54	Not Statistically Significantly Different
BROOKLINE	10.98	10.05	11.91	Not Statistically Significantly Different
BUCKLAND	5.17	1.88	8.46	Statistically Significantly Lower
BURLINGTON	8.42	7.37	9.48	Statistically Significantly Lower
CAMBRIDGE	10.81	9.95	11.68	Not Statistically Significantly Different
CANTON	13.13	11.80	14.46	Statistically Significantly Higher
CARLISLE*	5.79	4.20	7.38	Statistically Significantly Lower
CARVER	12.44	10.75	14.13	Not Statistically Significantly Different
CHARLEMONT	15.23	9.50	20.96	Not Statistically Significantly Different
CHARLTON	10.89	9.44	12.34	Not Statistically Significantly Different
CHATHAM	12.63	9.35	15.90	Not Statistically Significantly Different
CHELMSFORD	10.55	9.61	11.49	Not Statistically Significantly Different
CHELSEA	9.41	8.49	10.32	Statistically Significantly Lower
CHESHIRE	8.04	5.02	11.06	Not Statistically Significantly Different
CHESTER	10.83	5.97	15.69	Not Statistically Significantly Different
CHESTERFIELD	10.48	5.09	15.88	Not Statistically Significantly Different
CHICOPEE	10.3	9.51	11.09	Not Statistically Significantly Different
CHILMARK	8.82	2.08	15.57	Not Statistically Significantly Different
CLARKSBURG	9.81	5.83	13.80	Not Statistically Significantly Different
CLINTON	8.7	7.23	10.17	Statistically Significantly Lower
COHASSET	7.05	5.58	8.52	Statistically Significantly Lower
COLRAIN	15.79	10.32	21.25	Not Statistically Significantly Different
CONCORD	11.53	10.16	12.90	Not Statistically Significantly Different
CONWAY*	6.08	2.60	9.56	Statistically Significantly Lower
CUMMINGTON	8.86	2.59	15.13	Not Statistically Significantly Different
DALTON	8.64	6.77	10.51	Statistically Significantly Lower
DANVERS	7.44	6.46	8.43	Statistically Significantly Lower
DARTMOUTH	12.85	11.69	14.01	Statistically Significantly Higher
DEDHAM	12.08	10.78	13.37	Not Statistically Significantly Different
DEERFIELD	8.52	6.14	10.90	Not Statistically Significantly Different
DENNIS	9.07	7.35	10.80	Statistically Significantly Lower
DIGHTON	11.99	9.92	14.05	Not Statistically Significantly Different
DOUGLAS	9.81	8.14	11.48	Not Statistically Significantly Different
DOVER	8.59	6.88	10.30	Statistically Significantly Lower
DRACUT	10.38	9.38	11.39	Not Statistically Significantly Different
DUDLEY	11.17	9.48	12.85	Not Statistically Significantly Different
DUNSTABLE	8.3	5.93	10.68	Statistically Significantly Lower
DUXBURY	9.22	8.07	10.37	Statistically Significantly Lower
EAST BRIDGEWATER	6.91	5.74	8.08	Statistically Significantly Lower
EAST BROOKFIELD	6.69	3.62	9.77	Statistically Significantly Lower
EAST LONGMEADOW	12.28	10.82	13.74	Not Statistically Significantly Different
EASTHAM	13.85	10.29	17.41	Not Statistically Significantly Different
EASTHAMPTON	14.25	11.83	16.67	Statistically Significantly Higher
EASTON	9.33	8.26	10.41	Statistically Significantly Lower
EDGARTOWN*	13.08	9.63	16.53	Not Statistically Significantly Different
EGREMONT	16.84	9.32	24.37	Not Statistically Significantly Different
ERVING*	17.71	12.31	23.11	Statistically Significantly Higher
ESSEX	5.93	3.63	8.23	Statistically Significantly Lower

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
EVERETT	9.55	8.62	10.48	Statistically Significantly Lower
FAIRHAVEN	11.41	9.83	12.99	Not Statistically Significantly Different
FALL RIVER	13.62	12.92	14.31	Statistically Significantly Higher
FALMOUTH	11.83	10.63	13.04	Not Statistically Significantly Different
FITCHBURG	13.21	12.25	14.18	Statistically Significantly Higher
FLORIDA	5.56	0.82	10.29	Statistically Significantly Lower
FOXBOROUGH	14.53	13.03	16.03	Statistically Significantly Higher
FRAMINGHAM	10.31	9.56	11.06	Not Statistically Significantly Different
FRANKLIN	9.94	9.09	10.78	Statistically Significantly Lower
FREETOWN*	9.05	7.28	10.81	Not Statistically Significantly Different
GARDNER	15.24	13.72	16.76	Statistically Significantly Higher
AQUINNAH	6.25	0.00	14.64	Not Statistically Significantly Different
GEORGETOWN	6.97	5.52	8.42	Statistically Significantly Lower
GILL	10	5.20	14.80	Not Statistically Significantly Different
GLOUCESTER	11.28	10.11	12.46	Not Statistically Significantly Different
GOSHEN	12.36	5.52	19.20	Not Statistically Significantly Different
GRAFTON	10.04	8.79	11.29	Not Statistically Significantly Different
GRANBY	14.42	11.91	16.92	Statistically Significantly Higher
GRANVILLE	8.22	4.58	11.86	Not Statistically Significantly Different
GREAT BARRINGTON	8.61	6.03	11.19	Not Statistically Significantly Different
GREENFIELD	14.48	12.74	16.21	Statistically Significantly Higher
GROTON	8.62	7.33	9.91	Statistically Significantly Lower
GROVELAND	6.06	4.48	7.65	Statistically Significantly Lower
HADLEY	9.66	6.70	12.62	Not Statistically Significantly Different
HALIFAX*	4.4	3.10	5.70	Statistically Significantly Lower
HAMILTON	7.37	5.83	8.90	Statistically Significantly Lower
HAMPDEN	9.15	6.90	11.39	Not Statistically Significantly Different
HANCOCK	5.36	0.00	11.25	Not Statistically Significantly Different
HANOVER	8.84	7.63	10.06	Statistically Significantly Lower
HANSON	9.82	8.26	11.38	Not Statistically Significantly Different
HARDWICK	6.15	3.47	8.83	Statistically Significantly Lower
HARVARD	10.93	8.88	12.97	Not Statistically Significantly Different
HARWICH	6.78	5.26	8.30	Statistically Significantly Lower
HATFIELD	6.56	3.85	9.28	Statistically Significantly Lower
HAVERHILL	13.73	12.89	14.58	Statistically Significantly Higher
HAWLEY	0	0.00	0.00	Statistically Significantly Lower
HEATH	15	5.96	24.04	Not Statistically Significantly Different
HINGHAM	10.2	9.04	11.35	Not Statistically Significantly Different
HINSDALE	9.82	5.92	13.72	Not Statistically Significantly Different
HOLBROOK	11.15	9.35	12.95	Not Statistically Significantly Different
HOLDEN	6.88	5.85	7.91	Statistically Significantly Lower
HOLLAND*	12.71	8.89	16.54	Not Statistically Significantly Different
HOLLISTON	10.52	9.17	11.87	Not Statistically Significantly Different
HOLYOKE	17.9	16.74	19.07	Statistically Significantly Higher
HOPEDALE	7.26	5.51	9.02	Statistically Significantly Lower
HOPKINTON	8.03	6.98	9.08	Statistically Significantly Lower
HUBBARDSTON	10.6	8.29	12.92	Not Statistically Significantly Different
HUDSON	11.05	9.70	12.40	Not Statistically Significantly Different

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
HULL	13.35	11.18	15.52	Statistically Significantly Higher
HUNTINGTON	11.97	7.81	16.12	Not Statistically Significantly Different
IPSWICH	4.68	3.37	5.98	Statistically Significantly Lower
KINGSTON	9.27	7.86	10.67	Statistically Significantly Lower
LAKEVILLE*	6.87	5.54	8.19	Statistically Significantly Lower
LANCASTER	10.93	8.76	13.10	Not Statistically Significantly Different
LANESBOROUGH*	10.74	7.38	14.10	Not Statistically Significantly Different
LAWRENCE	16.71	15.99	17.42	Statistically Significantly Higher
LEE	5.98	4.06	7.90	Statistically Significantly Lower
LEICESTER	8.67	7.14	10.20	Statistically Significantly Lower
LENOX	15.32	12.11	18.53	Statistically Significantly Higher
LEOMINSTER	8.53	7.73	9.33	Statistically Significantly Lower
LEVERETT*	5.39	1.96	8.81	Statistically Significantly Lower
LEXINGTON	8.09	7.27	8.90	Statistically Significantly Lower
LEYDEN	8.45	1.98	14.92	Not Statistically Significantly Different
LINCOLN*	3.06	2.10	4.02	Statistically Significantly Lower
LITTLETON	7.05	5.63	8.47	Statistically Significantly Lower
LONGMEADOW	7.38	6.28	8.48	Statistically Significantly Lower
LOWELL	12.93	12.33	13.53	Statistically Significantly Higher
LUDLOW	11.94	10.56	13.33	Not Statistically Significantly Different
LUNENBURG	8.25	6.74	9.76	Statistically Significantly Lower
LYNN	10.08	9.49	10.66	Statistically Significantly Lower
LYNNFIELD	6.37	5.20	7.54	Statistically Significantly Lower
MALDEN	12.17	11.25	13.10	Statistically Significantly Higher
MANCHESTER	10	7.70	12.50	Not Statistically Significantly Different
MANSFIELD	12.98	11.90	14.07	Statistically Significantly Higher
MARBLEHEAD	6.23	5.27	7.19	Statistically Significantly Lower
MARION*	9.06	6.80	11.32	Not Statistically Significantly Different
MARLBOROUGH	11.78	10.76	12.80	Not Statistically Significantly Different
MARSHFIELD	7.62	6.73	8.50	Statistically Significantly Lower
MASHPEE	9.51	7.95	11.06	Not Statistically Significantly Different
MATTAPOISETT	7.74	5.74	9.74	Statistically Significantly Lower
MAYNARD	9.92	8.06	11.78	Not Statistically Significantly Different
MEDFIELD	10.93	9.64	12.22	Not Statistically Significantly Different
MEDFORD	8.42	7.60	9.25	Statistically Significantly Lower
MEDWAY	9.3	8.06	10.55	Statistically Significantly Lower
MELROSE	16.23	14.77	17.69	Statistically Significantly Higher
MENDON	10.62	8.65	12.58	Not Statistically Significantly Different
MERRIMAC	9.08	7.24	10.92	Not Statistically Significantly Different
METHUEN	6.33	5.69	6.96	Statistically Significantly Lower
MIDDLEBOROUGH	13.86	12.58	15.15	Statistically Significantly Higher
MIDDLEFIELD	15.69	5.71	25.67	Not Statistically Significantly Different
MIDDLETON*	8.4	6.75	10.05	Statistically Significantly Lower
MILFORD	10.14	9.07	11.21	Not Statistically Significantly Different
MILLBURY	12.27	10.55	13.99	Not Statistically Significantly Different
MILLIS	8.00	5.83	10.17	Statistically Significantly Lower
MILLVILLE	9.42	6.71	12.13	Not Statistically Significantly Different
MILTON	11.28	10.19	12.37	Not Statistically Significantly Different

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
MONROE	10.00	0.00	28.59	Not Statistically Significantly Different
MONSON	20.02	17.66	22.38	Statistically Significantly Higher
MONTAGUE	13.13	10.62	15.65	Not Statistically Significantly Different
MONTEREY	12.33	4.79	19.87	Not Statistically Significantly Different
MONTGOMERY	10.94	3.29	18.58	Not Statistically Significantly Different
MOUNT WASHINGTON	16.67	0.00	37.75	Not Statistically Significantly Different
NAHANT	9.12	5.90	12.34	Not Statistically Significantly Different
NANTUCKET	8.52	6.78	10.26	Statistically Significantly Lower
NATICK	10.39	9.40	11.37	Not Statistically Significantly Different
NEEDHAM	10.81	9.86	11.76	Not Statistically Significantly Different
NEW ASHFORD	0.00	0.00	0.00	Statistically Significantly Lower
NEW BEDFORD	15.06	14.39	15.73	Statistically Significantly Higher
NEW BRAINTREE	9.52	3.91	15.14	Not Statistically Significantly Different
NEW MARLBOROUGH	8.89	4.09	13.69	Not Statistically Significantly Different
NEW SALEM	13.16	6.95	19.36	Not Statistically Significantly Different
NEWBURY	5.58	4.01	7.15	Statistically Significantly Lower
NEWBURYPORT	7.44	6.23	8.66	Statistically Significantly Lower
NEWTON	9.47	8.86	10.07	Statistically Significantly Lower
NORFOLK*	9.54	8.02	11.05	Not Statistically Significantly Different
NORTH ADAMS	12.23	10.46	14.00	Not Statistically Significantly Different
NORTH ANDOVER	10.36	9.40	11.33	Not Statistically Significantly Different
NORTH ATTLEBOROUGH	13.45	12.37	14.54	Statistically Significantly Higher
NORTH BROOKFIELD	6.17	4.19	8.15	Statistically Significantly Lower
NORTH READING	10.61	9.28	11.95	Not Statistically Significantly Different
NORTHAMPTON	13.6	12.19	15.00	Statistically Significantly Higher
NORTHBOROUGH*	9.65	8.36	10.94	Not Statistically Significantly Different
NORTHBRIDGE	9.71	8.43	11.00	Not Statistically Significantly Different
NORTHFIELD	5.52	3.17	7.88	Statistically Significantly Lower
NORTON	9.18	8.05	10.32	Statistically Significantly Lower
NORWELL	8.92	7.55	10.28	Statistically Significantly Lower
NORWOOD	7.38	6.39	8.37	Statistically Significantly Lower
OAK BLUFFS*	8.71	6.09	11.32	Not Statistically Significantly Different
OAKHAM	10.44	6.64	14.24	Not Statistically Significantly Different
ORANGE	14.92	12.60	17.24	Statistically Significantly Higher
ORLEANS	9.94	6.62	13.26	Not Statistically Significantly Different
OTIS	13.08	6.69	19.47	Not Statistically Significantly Different
OXFORD	6.5	5.33	7.67	Statistically Significantly Lower
PALMER	15.99	14.08	17.91	Statistically Significantly Higher
PAXTON	3.58	2.00	5.17	Statistically Significantly Lower
PEABODY	9.71	8.90	10.53	Statistically Significantly Lower
PELHAM*	13.43	7.66	19.21	Not Statistically Significantly Different
PEMBROKE	8.74	7.62	9.85	Statistically Significantly Lower
PEPPERELL	11.87	10.30	13.45	Not Statistically Significantly Different
PERU	11.88	5.57	18.19	Not Statistically Significantly Different
PETERSHAM*	8.23	3.94	12.51	Not Statistically Significantly Different
PHILLIPSTON	8.62	5.01	12.23	Not Statistically Significantly Different
PITTSFIELD	10.43	9.56	11.30	Not Statistically Significantly Different

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
PLAINFIELD	10.17	2.46	17.88	Not Statistically Significantly Different
PLAINVILLE*	16.01	13.79	18.24	Statistically Significantly Higher
PLYMOUTH	9.89	9.15	10.62	Statistically Significantly Lower
PLYMPTON*	9.65	6.52	12.78	Not Statistically Significantly Different
PRINCETON	4.55	2.70	6.41	Statistically Significantly Lower
PROVINCETOWN	13.21	6.76	19.65	Not Statistically Significantly Different
QUINCY	9.88	9.14	10.62	Statistically Significantly Lower
RANDOLPH	12.95	11.76	14.13	Statistically Significantly Higher
RAYNHAM	4.91	3.90	5.92	Statistically Significantly Lower
READING	6.45	5.59	7.31	Statistically Significantly Lower
REHOBOTH	7.06	5.71	8.42	Statistically Significantly Lower
REVERE	8.21	7.40	9.02	Statistically Significantly Lower
RICHMOND	8.7	3.99	13.40	Not Statistically Significantly Different
ROCHESTER*	5.25	3.67	6.83	Statistically Significantly Lower
ROCKLAND	8.56	7.37	9.75	Statistically Significantly Lower
ROCKPORT	7.74	5.72	9.76	Statistically Significantly Lower
ROWE	23.81	10.93	36.69	Not Statistically Significantly Different
ROWLEY	7.61	5.73	9.49	Statistically Significantly Lower
ROYALSTON	8.97	4.49	13.46	Not Statistically Significantly Different
RUSSELL	8.95	4.89	13.01	Not Statistically Significantly Different
RUTLAND	7.01	5.59	8.44	Statistically Significantly Lower
SALEM	11.81	10.71	12.91	Not Statistically Significantly Different
SALISBURY	4.12	2.78	5.45	Statistically Significantly Lower
SANDISFIELD	3.75	0.00	7.91	Statistically Significantly Lower
SANDWICH	8.75	7.69	9.81	Statistically Significantly Lower
SAUGUS	10.22	9.06	11.39	Not Statistically Significantly Different
SAVOY	9.78	3.71	15.85	Not Statistically Significantly Different
SCITUATE	9.68	8.46	10.90	Not Statistically Significantly Different
SEEKONK	10.55	9.00	12.09	Not Statistically Significantly Different
SHARON	8.44	7.36	9.51	Statistically Significantly Lower
SHEFFIELD	14.71	11.09	18.34	Statistically Significantly Higher
SHELBURNE	21.62	14.99	28.25	Statistically Significantly Higher
SHERBORN	10.11	7.93	12.29	Not Statistically Significantly Different
SHIRLEY	9.59	7.39	11.79	Not Statistically Significantly Different
SHREWSBURY	9.6	8.76	10.43	Statistically Significantly Lower
SHUTESBURY*	6.06	2.74	9.38	Statistically Significantly Lower
SOMERSET	12.44	10.92	13.97	Not Statistically Significantly Different
SOMERVILLE	7.78	6.78	8.78	Statistically Significantly Lower
SOUTH HADLEY	10.39	8.88	11.91	Not Statistically Significantly Different
SOUTHAMPTON*	14.77	12.04	17.50	Statistically Significantly Higher
SOUTHBOROUGH	7.48	6.21	8.75	Statistically Significantly Lower
SOUTHBRIDGE	14.62	13.00	16.25	Statistically Significantly Higher
SOUTHWICK	10.74	9.01	12.47	Not Statistically Significantly Different
SPENCER	7.64	6.18	9.09	Statistically Significantly Lower
SPRINGFIELD	16.43	15.94	16.92	Statistically Significantly Higher
STERLING	8.63	6.89	10.38	Statistically Significantly Lower
STOCKBRIDGE	19.27	11.86	26.67	Statistically Significantly Higher
STONEHAM	8.9	7.75	10.06	Statistically Significantly Lower

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
STOUGHTON	11.36	10.18	12.53	Not Statistically Significantly Different
STOW	12.41	10.28	14.53	Not Statistically Significantly Different
STURBRIDGE*	6.9	5.40	8.39	Statistically Significantly Lower
SUDBURY	9.6	8.57	10.63	Statistically Significantly Lower
SUNDERLAND*	4.12	1.74	6.50	Statistically Significantly Lower
SUTTON	10.52	8.88	12.16	Not Statistically Significantly Different
SWAMPSCOTT	9.59	8.14	11.03	Not Statistically Significantly Different
SWANSEA	13.51	11.84	15.17	Statistically Significantly Higher
TAUNTON	10.98	10.21	11.74	Not Statistically Significantly Different
TEMPLETON	10.71	8.84	12.58	Not Statistically Significantly Different
TEWKSBURY	7.72	6.86	8.59	Statistically Significantly Lower
TOLLAND	12.77	3.23	22.31	Not Statistically Significantly Different
TOPSFIELD*	8.15	6.40	9.89	Statistically Significantly Lower
TOWNSEND	10.34	8.65	12.04	Not Statistically Significantly Different
TRURO	4.13	0.59	7.68	Statistically Significantly Lower
TYNGSBOROUGH	13.46	11.83	15.10	Statistically Significantly Higher
TYRINGHAM	8.00	0.00	18.63	Not Statistically Significantly Different
UPTON	8.7	7.06	10.34	Statistically Significantly Lower
UXBRIDGE	9.66	8.26	11.07	Not Statistically Significantly Different
WAKEFIELD	12.33	11.09	13.57	Statistically Significantly Higher
WALES*	12.56	8.13	16.99	Not Statistically Significantly Different
WALPOLE	9.67	8.64	10.70	Statistically Significantly Lower
WALTHAM	8.81	7.90	9.72	Statistically Significantly Lower
WARE	10.26	8.42	12.10	Not Statistically Significantly Different
WAREHAM	10.05	8.85	11.25	Not Statistically Significantly Different
WARREN	13.04	10.45	15.62	Not Statistically Significantly Different
WARWICK	16.88	8.52	25.25	Not Statistically Significantly Different
WASHINGTON	12.77	3.23	22.31	Not Statistically Significantly Different
WATERTOWN	8.55	7.31	9.79	Statistically Significantly Lower
WAYLAND	6.88	5.76	8.00	Statistically Significantly Lower
WEBSTER	9.03	7.68	10.38	Statistically Significantly Lower
WELLESLEY	9.4	8.48	10.32	Statistically Significantly Lower
WELLFLEET*	6.6	3.26	9.95	Statistically Significantly Lower
WENDELL	8.97	2.63	15.32	Not Statistically Significantly Different
WENHAM	7.52	5.38	9.66	Statistically Significantly Lower
WEST BOYLSTON	8.65	6.59	10.70	Statistically Significantly Lower
WEST BRIDGEWATER	8.23	6.30	10.16	Statistically Significantly Lower
WEST BROOKFIELD	43.07	34.77	51.36	Statistically Significantly Higher
WEST NEWBURY	8.68	6.47	10.89	Not Statistically Significantly Different
WEST SPRINGFIELD	9.71	8.64	10.78	Statistically Significantly Lower
WEST STOCKBRIDGE	7.21	2.40	12.02	Not Statistically Significantly Different
WEST TISBURY	5.54	2.81	8.26	Statistically Significantly Lower
WESTBOROUGH	11.43	10.14	12.72	Not Statistically Significantly Different
WESTFIELD	11.65	10.69	12.61	Not Statistically Significantly Different
WESTFORD	10.54	9.56	11.52	Not Statistically Significantly Different
WESTHAMPTON*	17.89	12.44	23.35	Statistically Significantly Higher
WESTMINSTER	9.33	7.43	11.23	Not Statistically Significantly Different
WESTON	12.16	10.64	13.68	Not Statistically Significantly Different

Community	Percent (%)	Lower 95% CL**	Upper 95% CL***	Comparison with Statewide Prevalence
WESTPORT	11.08	9.53	12.63	Not Statistically Significantly Different
WESTWOOD	8.86	7.68	10.04	Statistically Significantly Lower
WEYMOUTH	11.35	10.50	12.19	Not Statistically Significantly Different
WHATELY*	6.34	2.33	10.35	Statistically Significantly Lower
WHITMAN	9.22	7.84	10.60	Statistically Significantly Lower
WILBRAHAM	9.49	8.16	10.82	Not Statistically Significantly Different
WILLIAMSBURG	20.33	14.48	26.18	Statistically Significantly Higher
WILLIAMSTOWN	5.5	3.59	7.42	Statistically Significantly Lower
WILMINGTON	9.72	8.66	10.78	Statistically Significantly Lower
WINCHENDON	9.73	8.13	11.33	Not Statistically Significantly Different
WINCHESTER	9.82	8.72	10.93	Not Statistically Significantly Different
WINDSOR	6.45	2.13	10.78	Statistically Significantly Lower
WINTHROP	10.81	9.25	12.36	Not Statistically Significantly Different
WOBURN	10.72	9.71	11.73	Not Statistically Significantly Different
WORCESTER	11.72	11.26	12.18	Statistically Significantly Higher
WORTHINGTON	9.09	3.43	14.75	Not Statistically Significantly Different
WRENTHAM*	6.63	5.41	7.86	Statistically Significantly Lower
YARMOUTH	9.7	8.37	11.03	Not Statistically Significantly Different
Massachusetts Total	10.8	10.70	10.80	

†Lifetime asthma in the Pediatric Asthma Surveillance is a combination measure for the prevalence of lifetime and current asthma, see Appendix A for methodology.
* Represents communities participating in a regional school system.
** Lower 95% Confidence Limit
*** Upper 95% Confidence Limit
Map available in Figure 1.14.
Data Source: Pediatric Asthma Surveillance, Bureau of Environmental Health, Massachusetts Department of Public Health

Section 4. Hospital Treatment for Asthma

Supplemental data to Figure 4.3: Age-Specific Rates of Emergency Department Discharges due to Asthma, 2002-2005

Massachusetts Residents

	0-4 years			5-11 years			12–17 years		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2002	4,589	115.8	112.4-119.1	4,136	70.3	68.1-72.4	2,820	54.7	52.7-56.7
2003	5,043	127.7	124.1-131.2	4,531	78.7	76.4-81.0	3,110	59.8	57.7-61.9
2004	4,541	115.4	112.0-118.7	4,017	71.2	69.0-73.4	2,694	51.9	49.9-53.8
2005	4,535	115.4	112.1-118.8	3,982	71.8	69.6-74.1	2,688	51.9	49.9-53.8
	18-24 years			**25-34 years**			**35-44 years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2002	4,987	83.0	80.7-85.3	6,982	77.8	76.0-79.7	6,441	61.0	59.5-62.5
2003	5,336	87.6	85.3-90.0	7,006	79.6	77.7-81.5	6,703	64.3	62.8-65.9
2004	4,633	74.8	72.6-76.9	5,796	67.5	65.8-69.2	5,886	57.4	55.9-58.9
2005	4,862	77.6	75.4-79.8	5,935	70.7	68.9-72.5	6,146	60.8	59.3-62.3
	45-54 years			**55-64 years**			**65+ years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2002	4,311	47.04	45.6-48.4	2,024	33.7	32.2-35.1	1,723	20.1	19.1-21.0
2003	4,652	50.0	48.6-51.4	2,087	33.2	31.8-34.6	1,687	19.7	18.7-20.6
2004	4,097	43.4	42.1-44.7	1,974	30.1	28.8-31.4	1,697	19.8	18.9-20.8
2005	4,330	45.1	43.8-46.5	2,122	31.2	29.9-32.5	1,540	18.0	17.1-18.8

* Emergency department discharges due to asthma per 10,000 residents
Data Source: CY2002-2005 Massachusetts Emergency Department Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.5: Age-Sex-Specific Rates of Emergency Department Discharges due to Asthma, 2005

Massachusetts Residents

	Males			Females		
Age Group	**No.**	**Rate***	**95% CI**	**No.**	**Rate**	**95% CI**
0-4	2,977	148.7	143.4-154.1	1,557	81.3	77.3-85.3
5-11	2,534	89.6	86.1-93.0	1,448	53.6	50.8-56.3
12-17	1,236	46.6	44.0-49.2	1,458	57.7	54.7-60.6
18-24	1,922	61.7	58.9-64.4	2,940	93.6	90.2-97.0
25-34	2,536	60.7	58.3-63.1	3,399	80.8	78.1-83.5
35-44	2,346	47.2	45.3-49.1	3,800	74.0	71.7-76.4
45-54	1,460	31.3	29.7-32.9	2,870	58.3	56.2-60.4
55-64	724	22.3	20.6-23.9	1,398	39.4	37.3-41.4
65+	459	13.2	12.0-14.4	1,081	21.2	20.0-22.5
All Ages	16,194	52.0	51.2-52.8	19,951	60.1	59.3-60.9

* Emergency department discharges due to asthma per 10,000 residents

Data Source: CY2005 Massachusetts Emergency Department Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.10: Age-Specific Rates of Observation Stays due to Asthma, 2000-2005

Massachusetts Residents

	0-4 years			5-11 years			12–17 years		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	909	22.9	21.4-24.4	482	7.9	7.2-8.6	199	4.0	3.5-4.6
2001	955	24.1	22.5-25.6	468	7.8	7.1-8.5	179	3.6	3.0-4.1
2002	860	21.7	20.2-23.1	388	6.6	5.9-7.3	152	3.0	2.5-3.4
2003	869	22.0	20.5-23.5	392	6.8	6.1-7.5	156	3.0	2.5-3.5
2004	770	19.6	18.2-21.0	298	5.3	4.7-5.9	123	2.4	2.0-2.8
2005	618	15.8	14.5-17.0	270	4.9	4.3-5.5	119	2.3	1.9-2.7
	18-24 years			**25-34 years**			**35-44 years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	195	3.4	2.9-3.8	375	4.1	3.6-4.5	393	3.7	3.3-4.1
2001	176	3.0	2.5-3.4	276	3.0	2.7-3.4	331	3.1	2.8-3.5
2002	160	2.7	2.3-3.1	227	2.5	2.2-2.9	267	2.5	2.2-2.8
2003	135	2.2	1.8-2.6	218	2.5	2.2-2.8	246	2.4	2.1-2.7
2004	114	1.8	1.5-2.2	188	2.2	1.9-2.5	247	2.4	2.1-2.7
2005	112	1.8	1.5-2.1	179	2.1	1.8-2.5	264	2.6	2.3-2.9
	45-54 years			**55-64 years**			**65+ years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	311	3.5	3.1-3.9	156	2.8	2.4-3.3	207	2.4	2.1-2.7
2001	229	2.5	2.2-2.8	141	2.5	2.1-2.9	138	1.6	1.3-1.9
2002	231	2.5	2.2-2.9	138	2.3	1.9-2.7	141	1.6	1.4-1.9
2003	218	2.3	2.0-2.7	152	2.4	2.0-2.8	148	1.7	1.5-2.0
2004	262	2.8	2.4-3.1	158	2.4	2.0-2.8	155	1.8	1.5-2.1
2005	225	2.4	2.0-2.7	139	2.0	1.7-2.4	175	2.0	1.7-2.4

*Observation stays due to asthma per 10,000 residents

Data Source: CY2000-2005 Massachusetts Outpatient Observation Stays Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.12: Age-Sex-Specific Rates of Observation Stays due to Asthma, 2005

Massachusetts Residents

Age Group (Years)	Males			Females		
	No.	Rate*	95% CI	No.	Rate*	95% CI
0-4	412	20.6	18.6-22.6	206	10.8	9.3-12.3
5-11	173	6.1	5.2-7.0	97	3.6	2.9-4.3
12-17	60	2.3	1.7-2.9	59	2.3	1.7-2.9
18-24	43	1.4	1.0-1.8	69	2.2	1.7-2.7
25-34	61	1.5	1.1-1.9	118	2.8	2.3-3.3
35-44	88	1.8	1.4-2.2	176	3.4	2.9-3.9
45-54	80	1.7	1.3-2.1	145	2.9	2.4-3.4
55-64	47	1.4	1.0-1.8	92	2.6	2.1-3.1
65+	48	1.4	1.0-1.8	127	2.5	2.1-2.9
All Ages	1,012	3.2	3.0-3.4	1,089	3.3	3.1-3.5

*Observation stays due to asthma per 10,000 residents

Data Source: CY2005 Massachusetts Outpatient Observation Stays Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.15: Age-adjusted and Crude Rates of Hospitalization due to Asthma in Massachusetts, 1994-2006

Massachusetts Residents

Year	Number	Crude rate per 10,000	Lower 95% CL*	Upper 95% CL**	Age-adjusted rate per 10,000	Lower 95% CL*	Upper 95% CL**
1994	11,078	18.1	17.8	18.5	18.4	18.0	18.7
1995	9,839	16.0	15.7	16.3	16.2	15.9	16.6
1996	9,102	14.7	14.4	15.0	15.0	14.6	15.3
1997	8,471	13.6	13.3	13.9	13.9	13.6	14.2
1998	7,932	12.6	12.3	12.9	12.7	12.4	13.0
1999	8,497	13.4	13.1	13.7	13.5	13.2	13.8
2000	8,118	12.8	12.5	13.0	12.8	12.5	13.1
2001	8,283	12.9	12.7	13.2	13.1	12.8	13.4
2002	8,100	12.6	12.3	12.9	12.7	12.4	13.0
2003	9,865	15.3	15.0	15.6	15.4	15.1	15.7
2004	8,888	13.8	13.5	14.1	13.8	13.5	14.1
2005	9,121	14.2	13.9	14.5	14.0	13.7	14.3
2006	9,457	14.7	14.4	15.0	14.7	14.4	15.0

* Lower 95% Confidence Limit

** Upper 95% Confidence Limit

Data Source: CY1994-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.17: Age-Specific Rates of Hospitalization due to Asthma, 2000-2006
Massachusetts Residents

	0-4 years			5-11 years			12–17 years		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	1,071	27.0	25.3 - 28.6	797	13.1	12.2 - 14.0	408	8.2	7.4 – 9.0
2001	1,391	35.0	33.2 - 36.9	855	14.2	13.2 - 15.1	401	8.0	7.2 - 8.7
2002	1,290	32.5	30.8 - 34.3	810	13.8	12.8 - 14.7	360	7.0	6.3 - 7.7
2003	1,649	41.7	39.7 - 43.8	1,007	17.5	16.4 - 18.6	471	9.1	8.2 - 9.9
2004	1,419	36.1	34.2 - 37.9	825	14.6	13.6 - 15.6	356	6.9	6.1 - 7.6
2005	1,271	32.4	30.7 - 34.2	780	14.1	13.1 - 15.1	324	6.3	5.6 - 6.9
2006	1,532	39.5	37.4 - 41.4	934	17.0	16.0 – 18.1	380	7.4	6.7 – 8.2
	18-24 years			**25-34 years**			**35-44 years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	405	7.0	6.3 - 7.6	710	7.7	7.1 - 8.2	1,221	11.5	10.8 - 12.1
2001	342	5.8	5.2 - 6.4	754	8.3	7.7 - 8.9	1,095	10.3	9.7 - 10.9
2002	371	6.2	5.5 - 6.8	618	6.9	6.3 - 7.4	1,103	10.4	9.8 - 11.1
2003	416	6.8	6.2 - 7.5	776	8.8	8.2 - 9.4	1,271	12.2	11.5 - 12.9
2004	285	4.6	4.1 - 5.1	561	6.5	6.0 - 7.1	1,109	10.8	10.2 - 11.5
2005	320	5.1	4.6 - 5.7	519	6.2	5.7 - 6.7	1,110	11.0	10.3 - 11.6
2006	336	5.3	4.7 – 5.9	505	6.1	5.6 - 6.6	1,053	10.6	10.0 – 11.2
	45-54 years			**55-64 years**			**65+ years**		
Year	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**	**No.**	**Rate***	**95% CI**
2000	1,140	12.9	12.2 - 13.7	848	15.4	14.4 - 16.5	1,518	17.6	16.7 - 18.5
2001	1,110	12.2	11.5 - 12.9	847	15.0	14.0 - 16.0	1,488	17.3	16.4 - 18.2
2002	1,187	13.0	12.2 - 13.7	817	13.6	12.7 - 14.5	1,544	18.0	17.1 - 18.9
2003	1,371	14.7	14.0 - 15.5	1,010	16.1	15.1 - 17.1	1,894	22.1	21.1 - 23.1
2004	1,227	13.0	12.3 - 13.7	1,116	17.0	16.0 - 18.0	1,990	23.2	22.2 - 24.3
2005	1,390	14.5	13.7 - 15.3	1,172	17.2	16.2 - 18.2	2,235	26.1	25.0 - 27.2
2006	1,315	13.5	12.8 - 14.3	1,148	16.3	15.3 - 17.2	2,254	26.3	25.2 - 27.3

*Hospitalizations due to asthma per 10,000 residents
Data Source: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Figure 4.19: Age-Sex-Specific Rates of Hospitalization due to Asthma, 2006
Massachusetts Residents

	Males			Females		
Age Group	**No.**	**Rate***	**95% CI**	**No.**	**Rate**	**95% CI**
0-4	869	43.9	41.0-46.8	481	25.3	23.1-27.6
5-11	475	17.0	15.4-18.5	353	13.2	11.8-14.5
12-17	177	6.7	5.7-7.7	168	6.7	5.7-7.7
18-24	105	3.3	2.7-4.0	221	6.9	6.0-7.9
25-34	160	3.9	3.3-4.5	334	8.1	7.2-8.9
35-44	342	7.0	6.3-7.7	677	13.4	12.4-14.4
45-54	330	7.0	6.2-7.7	949	19.0	17.8-20.3
55-64	304	9.0	8.0-10.0	817	22.2	20.7-23.7
65+	643	18.5	17.1-19.9	1,546	30.4	28.9-31.9
All Ages	3,405	10.9	10.6-11.3	5,546	16.7	16.3-17.1

*Hospitalizations due to asthma per 10,000 residents
Data Source: CY2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy

Supplemental data to Map 4.3: Crude Rates of Hospitalization due to Asthma (Primary Diagnosis) by City/Town of Residence, 2004-2006

Massachusetts Residents

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
ABINGTON	62	12.68	9.52-15.83
ACTON	28	4.54	2.86-6.23
ACUSHNET	59	18.67	13.90-23.43
ADAMS	16	6.31	3.22-9.40
AGAWAM	69	8.06	6.16-9.96
ALFORD	<7	--	--
AMESBURY	73	14.64	11.28-18.00
AMHERST	45	4.31	3.05-5.57
ANDOVER	61	6.19	4.64-7.75
ARLINGTON	105	8.48	6.86-10.10
ASHBURNHAM	25	13.96	8.49-19.43
ASHBY	11	12.53	5.13-19.94
ASHFIELD	<7	--	--
ASHLAND	62	13.39	10.06-16.73
ATHOL	65	18.42	13.93-22.91
ATTLEBORO	129	9.92	8.20-11.63
AUBURN	44	8.95	6.30-11.59
AVON	36	27.62	18.60-36.64
AYER	40	18.49	12.76-24.22
BARNSTABLE	104	7.24	5.85-8.63
BARRE	10	6.2	2.36-10.05
BECKET	<7	--	--
BEDFORD	28	7.48	4.71-10.24
BELCHERTOWN	31	7.44	4.82-10.05
BELLINGHAM	43	9.11	6.39-11.83
BELMONT	32	4.55	2.97-6.12
BERKLEY	14	7.35	3.50-11.20
BERLIN	7	8.7	2.25-15.14
BERNARDSTON	<7	--	--
BEVERLY	222	18.58	16.13-21.02
BILLERICA	122	10.21	8.40-12.03
BLACKSTONE	14	5.16	2.46-7.86
BLANDFORD	0	0	--
BOLTON	<7	--	--
BOSTON	4,314	25.75	24.98-26.52
BOURNE	86	14.81	11.68-17.94
BOXBOROUGH	13	8.61	3.93-13.29
BOXFORD	16	6.53	3.33-9.74
BOYLSTON	10	7.84	2.98-12.70
BRAINTREE	126	12.48	10.30-14.66
BREWSTER	18	5.86	3.15-8.56
BRIDGEWATER	76	9.83	7.62-12.04
BRIMFIELD	14	12.87	6.13-19.61
BROCKTON	834	27.7	25.82-29.58
BROOKFIELD	17	18.3	9.60-27.00
BROOKLINE	123	7.25	5.97-8.53
BUCKLAND	0	0	--
BURLINGTON	71	10.17	7.81-12.54
CAMBRIDGE	279	9.16	8.09-10.23
CANTON	68	10.55	8.04-13.06
CARLISLE	<7	--	--
CARVER	62	17.89	13.44-22.34
CHARLEMONT	<7	--	--

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
CHARLTON	39	10.44	7.17-13.72
CHATHAM	9	4.39	1.52-7.26
CHELMSFORD	104	10.28	8.30-12.25
CHELSEA	159	15.53	13.12-17.94
CHESHIRE	10	9.93	3.78-16.09
CHESTER	<7	--	--
CHESTERFIELD	<7	--	--
CHICOPEE	256	15.63	13.71-17.54
CHILMARK	<7	--	--
CLARKSBURG	<7	--	--
CLINTON	55	13.1	9.64-16.56
COHASSET	16	7.39	3.77-11.01
COLRAIN	<7	--	--
CONCORD	19	3.76	2.07-5.45
CONWAY	<7	--	--
CUMMINGTON	<7	--	--
DALTON	13	6.47	2.95-9.99
DANVERS	93	11.92	9.50-14.35
DARTMOUTH	135	14.34	11.92-16.76
DEDHAM	79	11.12	8.67-13.57
DEERFIELD	<7	--	--
DENNIS	48	10.05	7.21-12.90
DIGHTON	20	10.03	5.63-14.42
DOUGLAS	22	9.33	5.43-13.23
DOVER	8	4.73	1.45-8.01
DRACUT	104	12.03	9.72-14.35
DUDLEY	36	11.12	7.49-14.76
DUNSTABLE	<7	--	--
DUXBURY	34	7.73	5.13-10.33
EAST BRIDGEWATER	46	11.09	7.88-14.29
EAST BROOKFIELD	7	11.05	2.86-19.24
EAST LONGMEADOW	22	4.94	2.88-7.00
EASTHAM	8	4.8	1.48-8.13
EASTHAMPTON	43	8.91	6.24-11.59
EASTON	64	9.28	7.00-11.55
EDGARTOWN	7	5.93	1.54-10.33
EGREMONT	<7	--	--
ERVING	<7	--	--
ESSEX	<7	--	--
EVERETT	177	15.9	13.56-18.25
FAIRHAVEN	72	14.79	11.38-18.21
FALL RIVER	975	35.28	33.07-37.50
FALMOUTH	141	13.98	11.67-16.29
FITCHBURG	230	18.92	16.48-21.37
FLORIDA	<7	--	--
FOXBOROUGH	75	15.35	11.87-18.82
FRAMINGHAM	291	14.78	13.08-16.47
FRANKLIN	67	7.26	5.52-9.00
FREETOWN	42	15.62	10.90-20.34
GARDNER	145	23.07	19.31-26.82
GAY HEAD	0	--	--
GEORGETOWN	27	11.22	6.99-15.45
GILL	<7	--	--
GLOUCESTER	128	13.91	11.50-16.32
GOSHEN	<7	--	--
GOSNOLD	0	0	--

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
GRAFTON	48	9.53	6.84-12.23
GRANBY	15	7.9	3.90-11.89
GRANVILLE	0	0	--
GREAT BARRINGTON	18	8.21	4.45-11.97
GREENFIELD	54	10.03	7.35-12.70
GROTON	25	8.02	4.87-11.16
GROVELAND	26	13.15	8.09-18.20
HADLEY	<7	--	--
HALIFAX	27	11.53	7.18-15.88
HAMILTON	14	5.6	2.67-8.53
HAMPDEN	11	6.9	2.82-10.98
HANCOCK	<7	--	--
HANOVER	27	6.39	3.98-8.81
HANSON	36	12.1	8.15-16.06
HARDWICK	<7	--	--
HARVARD	<7	--	--
HARWICH	18	4.73	2.55-6.92
HATFIELD	7	7.11	1.84-12.38
HAVERHILL	315	17.49	15.56-19.42
HAWLEY	0	4.06	--
HEATH	0	0	--
HINGHAM	49	7.61	5.48-9.74
HINSDALE	<7	--	--
HOLBROOK	52	16.1	11.73-20.48
HOLDEN	51	10.26	7.44-13.07
HOLLAND	9	11.86	4.11-19.61
HOLLISTON	40	9.64	6.65-12.63
HOLYOKE	329	26.69	23.81-29.57
HOPEDALE	17	9.09	4.77-13.41
HOPKINTON	27	6.41	3.99-8.82
HUBBARDSTON	<7	--	--
HUDSON	38	6.72	4.58-8.86
HULL	72	21.28	16.36-26.19
HUNTINGTON	<7	--	--
IPSWICH	52	13.05	9.50-16.59
KINGSTON	57	15.28	11.31-19.25
LAKEVILLE	36	11.3	7.61-14.99
LANCASTER	7	3.3	0.86-5.75
LANESBOROUGH	<7	--	--
LAWRENCE	477	19.49	17.74-21.24
LEE	9	5.1	1.77-8.43
LEICESTER	52	15.83	11.52-20.13
LENOX	14	9.06	4.32-13.81
LEOMINSTER	156	12.35	10.41-14.28
LEVERETT	<7	--	--
LEXINGTON	52	5.69	4.14-7.24
LEYDEN	<7	--	--
LINCOLN	11	4.62	1.89-7.35
LITTLETON	19	7.4	4.07-10.72
LONGMEADOW	31	6.64	4.30-8.98
LOWELL	628	19.8	18.25-21.34
LUDLOW	40	6.11	4.21-8.00
LUNENBURG	29	9.66	6.14-13.17
LYNN	568	20.54	18.85-22.23
LYNNFIELD	34	9.82	6.52-13.12
MALDEN	245	14.4	12.59-16.20

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
MANCHESTER	18	11.25	6.05-16.45
MANSFIELD	60	8.72	6.51-10.93
MARBLEHEAD	39	6.41	4.40-8.42
MARION	15	9.41	4.65-14.17
MARLBOROUGH	125	11.21	9.25-13.18
MARSHFIELD	55	7.37	5.42-9.32
MASHPEE	56	13.18	9.73-16.64
MATTAPOISETT	22	11.32	6.59-16.05
MAYNARD	34	11.09	7.36-14.82
MEDFIELD	17	4.6	2.41-6.78
MEDFORD	196	12.14	10.44-13.84
MEDWAY	28	7.3	4.60-10.01
MELROSE	97	12.26	9.82-14.70
MENDON	10	5.8	2.21-9.40
MERRIMAC	32	16.8	10.98-22.62
METHUEN	232	17.37	15.13-19.60
MIDDLEBOROUGH	74	11.66	9.00-14.32
MIDDLEFIELD	0	0	--
MIDDLETON	14	5.14	2.45-7.83
MILFORD	91	11.02	8.76-13.29
MILLBURY	47	11.65	8.32-14.99
MILLIS	21	8.81	5.04-12.57
MILLVILLE	7	7.94	2.06-13.83
MILTON	107	13.59	11.02-16.17
MONROE	0	0	--
MONSON	13	4.96	2.26-7.65
MONTAGUE	25	9.8	5.94-13.66
MONTEREY	<7	--	--
MONTGOMERY	<7	--	--
MOUNT WASHINGTON	0	3.7	--
NAHANT	13	12.07	5.51-18.63
NANTUCKET	11	3.63	1.49-5.78
NATICK	101	10.56	8.50-12.61
NEEDHAM	50	5.86	4.24-7.48
NEW ASHFORD	0	2.83	--
NEW BEDFORD	897	31.64	29.57-33.71
NEW BRAINTREE	<7	--	--
NEW MARLBOROUGH	<7	--	--
NEW SALEM	<7	--	--
NEWBURY	10	4.77	1.81-7.72
NEWBURYPORT	59	11.31	8.42-14.19
NEWTON	171	6.83	5.80-7.85
NORFOLK	13	4.12	1.88-6.37
NORTH ADAMS	30	7.1	4.55-9.64
NORTH ANDOVER	53	6.51	4.76-8.26
NORTH ATTLEBOROUGH	40	4.75	3.28-6.22
NORTH BROOKFIELD	9	6.23	2.16-10.31
NORTH READING	57	13.64	10.10-17.18
NORTHAMPTON	102	11.8	9.51-14.10
NORTHBOROUGH	36	8.19	5.51-10.87
NORTHBRIDGE	46	10.81	7.69-13.93
NORTHFIELD	<7	--	--
NORTON	47	8.2	5.86-10.54
NORWELL	12	3.85	1.67-6.03
NORWOOD	122	14.28	11.75-16.82
OAK BLUFFS	<7	--	--

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
OAKHAM	8	14.09	4.33-23.86
ORANGE	40	17.23	11.87-22.60
ORLEANS	8	4.13	1.27-6.99
OTIS	<7	--	--
OXFORD	60	14.59	10.90-18.28
PALMER	34	8.79	5.83-11.74
PAXTON	<7	--	--
PEABODY	170	11.12	9.45-12.79
PELHAM	<7	--	--
PEMBROKE	40	7.38	5.09-9.67
PEPPERELL	23	6.73	3.98-9.49
PERU	<7	--	--
PETERSHAM	<7	--	--
PHILLIPSTON	10	18.79	7.07-30.50
PITTSFIELD	193	14.64	12.57-16.70
PLAINFIELD	<7	--	--
PLAINVILLE	29	12.09	7.69-16.49
PLYMOUTH	229	13.93	12.13-15.74
PLYMPTON	<7	--	--
PRINCETON	<7	--	--
PROVINCETOWN	<7	--	--
QUINCY	383	14.11	12.70-15.53
RANDOLPH	163	16.69	14.13-19.25
RAYNHAM	44	10.92	7.70-14.15
READING	74	10.65	8.22-13.08
REHOBOTH	11	3.27	1.34-5.20
REVERE	278	20.34	17.95-22.73
RICHMOND	<7	--	--
ROCHESTER	20	12.59	7.07-18.11
ROCKLAND	97	18.12	14.52-21.73
ROCKPORT	26	11.17	6.87-15.46
ROWE	<7	--	--
ROWLEY	15	8.57	4.23-12.91
ROYALSTON	<7	--	--
RUSSELL	<7	--	--
RUTLAND	22	9.9	5.76-14.04
SALEM	176	14.09	12.01-16.17
SALISBURY	51	20.57	14.93-26.22
SANDISFIELD	<7	--	--
SANDWICH	37	5.96	4.04-7.88
SAUGUS	92	11.41	9.08-13.75
SAVOY	<7	--	--
SCITUATE	50	9.2	6.65-11.75
SEEKONK	8	1.95	0.60-3.30
SHARON	38	7.33	5.00-9.67
SHEFFIELD	<7	--	--
SHELBURNE	<7	--	--
SHERBORN	7	5.53	1.43-9.63
SHIRLEY	22	9.96	5.80-14.13
SHREWSBURY	97	9.75	7.81-11.69
SHUTESBURY	0	0	--
SOMERSET	88	15.8	12.50-19.10
SOMERVILLE	186	8.23	7.04-9.41
SOUTH HADLEY	44	8.59	6.05-11.13
SOUTHAMPTON	10	5.72	2.17-9.26
SOUTHBOROUGH	25	8.76	5.33-12.20

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
SOUTHBRIDGE	165	31.42	26.63-36.22
SOUTHWICK	15	5.26	2.60-7.92
SPENCER	51	14.06	10.20-17.92
SPRINGFIELD	1,152	24.56	23.14-25.98
STERLING	14	6.01	2.86-9.16
STOCKBRIDGE	<7	--	--
STONEHAM	90	13.89	11.02-16.76
STOUGHTON	124	15.43	12.72-18.15
STOW	16	8.66	4.42-12.90
STURBRIDGE	43	16.24	11.39-21.10
SUDBURY	29	5.67	3.61-7.74
SUNDERLAND	<7	--	--
SUTTON	15	5.57	2.75-8.39
SWAMPSCOTT	32	7.47	4.88-10.06
SWANSEA	96	19.7	15.76-23.64
TAUNTON	324	19.17	17.08-21.25
TEMPLETON	28	12.49	7.86-17.11
TEWKSBURY	76	8.74	6.77-10.70
TISBURY	14	12.22	5.82-18.62
TOLLAND	0	0	--
TOPSFIELD	15	8.09	4.00-12.19
TOWNSEND	35	12.58	8.41-16.75
TRURO	<7	--	--
TYNGSBOROUGH	36	10.62	7.15-14.09
TYRINGHAM	0	0	--
UPTON	15	7.84	--
UXBRIDGE	50	13.47	9.73-17.20
WAKEFIELD	60	8.15	6.08-10.21
WALES	<7	--	--
WALPOLE	94	13.58	10.84-16.33
WALTHAM	167	9.35	7.93-10.76
WARE	22	7.34	4.27-10.41
WAREHAM	144	22.56	18.88-26.25
WARREN	16	10.58	5.40-15.77
WARWICK	0	1.75	--
WASHINGTON	<7	--	--
WATERTOWN	77	7.96	6.18-9.73
WAYLAND	21	5.38	3.08-7.68
WEBSTER	97	19.19	15.37-23.00
WELLESLEY	36	4.45	3.00-5.90
WELLFLEET	<7	--	--
WENDELL	0	0	--
WENHAM	12	8.62	3.74-13.49
WEST BOYLSTON	20	8.65	4.86-12.44
WEST BRIDGEWATER	29	14.18	9.02-19.34
WEST BROOKFIELD	13	11.12	5.08-17.17
WEST NEWBURY	9	6.98	2.42-11.53
WEST SPRINGFIELD	87	10.38	8.20-12.56
WEST STOCKBRIDGE	<7	--	--
WEST TISBURY	<7	--	--
WESTBOROUGH	79	14.02	10.93-17.11
WESTFIELD	69	5.66	4.32-7.00
WESTFORD	50	7.8	5.64-9.96
WESTHAMPTON	<7	--	--
WESTMINSTER	25	11.33	6.89-15.77
WESTON	16	4.6	2.35-6.86

Town	2004-2006 Total Cases	Avg. Annual Crude Rate per 10,000	95% CI
WESTPORT	98	21.7	17.40-26.00
WESTWOOD	28	6.71	4.23-9.20
WEYMOUTH	235	14.59	12.72-16.45
WHATELY	<7	--	--
WHITMAN	45	10.4	7.36-13.44
WILBRAHAM	25	5.97	3.63-8.31
WILLIAMSBURG	<7	--	--
WILLIAMSTOWN	<7	--	--
WILMINGTON	76	11.82	9.16-14.48
WINCHENDON	57	18.84	13.95-23.73
WINCHESTER	78	12.3	9.57-15.03
WINDSOR	0	0	--
WINTHROP	52	10.16	7.40-12.92
WOBURN	176	15.82	13.49-18.16
WORCESTER	1,142	21.17	19.94-22.39
WORTHINGTON	<7	--	--
WRENTHAM	25	7.53	4.58-10.48
YARMOUTH	67	9.06	6.89-11.22

Data Source: CY2004-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Division of Health Care Finance and Policy

Supplemental data to Figure 4.22: Average Length of Stay of Hospitalizations due to Asthma, 2000-2006

Massachusetts Residents

	Length of Stay (Days)			
Year	Mean	Median	Minimum	Maximum
2000	3.4	3.0	1.0	78.0
2001	3.3	2.0	1.0	70.0
2002	3.4	3.0	1.0	77.0
2003	3.4	2.0	1.0	92.0
2004	3.5	3.0	1.0	68.0
2005	3.5	3.0	1.0	88.0
2006	3.5	3.0	1.0	85.0

Data Source: CY2000-2006 Massachusetts Inpatient Hospital Discharge Database, Massachusetts Health Care Finance and Policy

Burden of Asthma in Massachusetts: Evaluation Form

To our readers:
In an attempt to better serve our users, we are enclosing this evaluation form. Please take the time to complete this questionnaire and return it to the address at the bottom of the page. Thank you.

What tables and charts do you find most useful?

What tables and charts do you find least useful?

Are there other tables and charts that you would like to see added to this publication? If yes, please describe them in detail.

How will you use the information from this report in your work? Check all that apply.

- □ Educational presentation
- □ Advocate for policy change
- □ Initiate research activities
- □ Educate patients
- □ Other (please specify) _____

What best describes you? Check all that apply.

- □ Community planner
- □ Researcher
- □ Health care provider
- □ A person with asthma
- □ Government/policy maker
- □ Other (please specify) _____

Name one thing you learned from this report.

Do you have other comments or suggestions?

Please return your form to:
Carrie Huisingh, MPH
Bureau of Community Health Access and Promotion
Massachusetts Department of Public Health
250 Washington Street, 4th floor
Boston, MA 02108
Fax: 617-624-5075

References

[1] Akinbami L. Asthma prevalence, health care use and mortality: United States, 2003-2005. National Centers for Health Statistics. Accessed on February 10, 2009 at http://www.cdc.gov/nchs/products/pubs/pubd/hestats/ashtma03-05/asthma03-05.htm

[2] Childhood asthma. National Academy on an Aging Society, 2000. Accessed February 18, 2009 at http://hpi.georgetown.edu/agingsociety/pdfs/asthma.pdf

[3] Moorman J, Rudd RA, Johnson C, King M, Minor P, Bailey C, Scalia M, and Akinbami L. National surveillance for asthma – United States, 1980-2004. Centers for Disease Control and Prevention, MMWR. October 19, 2007. 56(SS-08); 1-54.

[4] Akinbami L. The state of childhood asthma, United States, 1980-2005. Advance Data from Vital and Health Statistics: no 381, Revised December 29, 2006 Hyattsville, MD: National Centers for Health Statistics. 2006.

[5] Asthma in New England, 2006. Asthma Regional Council, (in press).

[6] American Lung Association, Epidemiology and Statistics Unit, Research and Program Services. Trends in Asthma Morbidity and Mortality. November 2007. Accessed January 15, 2009 at http://www.lungusa.org/atf/cf/{7a8d42c2-fcca-4604-8ade-7f5d5e762256}/ASTHMA_TREND_NOV2007.PDF

[7] Mayo Clinic. Asthma. Accessed January 26, 2009 at http://www.mayoclinic.com/health/asthma/DS00021

[8] Tarlo SM et al. Diagnosis and management of work-related asthma. Chester 2008; 134: 1A-41S. Available at http://www.chestjournal.org/cgi/reprint/134/3_suppl/1S

[9] Reed CE. The natural history of asthma. J Allergy Clin Immunol 118(3):543-8. 2006.

[10] Smith L, Hatcher-Ross JL, Wertheimer R, and Kahn R. Rethinking race/ethnicity, income, and childhood asthma: racial/ethnic disparities concentrated among the very poor. Public Health Reports March-April (120):109-120. 2005.

[11] National Asthma Education and Prevention Program Expert Panel Report 3. Guidelines for the diagnosis and management of asthma. U.S. Department of Health and Human Services, National Institutes of Health, National Heart, Lung and Blood Institute. 2007

[12] Bleecker ER. Similarities and differences in asthma and COPD. CHEST. August 2004. vol 126, no 2, 935-955. Accessed on January 26, 2009 at http://www.chestjournal.org/content/126/2_suppl_1/93S.full?etoc

[13] Yeatts K, Shy C, Sotir M, Music S, and Herget C. Health Consequences for Children with Undiagnosed Asthma-like Symptoms. Archives of Pediatric Adolescent Medicine 2003; 157:540-544

[14] The Institute of Medicine's (IOM) 2000 report *Clearing the Air: Asthma and Indoor Air Exposures.*

[15] The Institute of Medicine's (IOM) report *Damp Indoor Spaces and Health*. CA Asthma Study on highways, Roz's studies and EPR3.

[16] Asthma and Allergies, Prevention of Occupational Asthma: Primer. National Institute of Occupational Safety and Health. Accessed on February 23, 2009 at http://www.cdc.gov/niosh/topics/asthma/OccAsthmaPrevention-primer.html

[17] Massachusetts Asthma Advocacy Partnership and Massachusetts Department of Public Health. Massachusetts Asthma Plan, 2009-2014. (pending).

[18] National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System. Available at http://www.cdc.gov/brfss/index.htm

[19] Bloom B, Cohen RA. Summary Health Statistics for US Children: National Health Interview Survey, 2006. National Center for Health Statistics. Vital Health Stat 10(234). 2007

[20] Horwood LJ, Fergusson DM, Shannon FT. Social and familial factors in the development of early childhood asthma. *Pediatrics* 1985;75(5):859–68.

[21] Child and Adolescent Health Measurement Initiative. 2003 National Survey of Children's Health, Data Resource Center for Child and Adolescent Health website. Retrieved [01/10/09] from www.nschdata.org

[22] Pleis JR, Lethbridge-Cejku M. Summary health statistics for US adults: National Health Interview Survey, 2006. National Center for Health Statistics. Vital Health Stat 10(235). 2007.

[23] 2007 American Community Survey 1-year Estimates, Survey: American Community Survey, Geographic Area: Massachusetts.

[24] Massachusetts Department of Public Health, Bureau of Environmental Health. Pediatric Asthma in Massachusetts 2005-2006. June 2007.
[25] Massachusetts Department of Elementary and Secondary Education and the Massachusetts Department of Public Health. Health and risk behaviors of Massachusetts youth, 2007: the report. May 2008. Accessed on January 26, 2009 at http://www.doe.mass.edu/cnp/hprograms/yrbs/2007YRBS.pdf
[26] Eaton DK et al. Youth Risk Behavior Surveillance – United States, 2007. Centers for Disease Control and Prevention. MMWR. June 6, 2008; 57(SS-4).
[27] University of Massachusetts Medical School Center for Health Policy and Research, MassHealth Office of Acute and Ambulatory Care, MassHealth Behavioral Health Program, and MassHealth Office of Clinical Affairs. MassHealth Managed Care HEDIS 2008 Final Report. November 2008.
[28] Asthma self-management education among youths and adults – United States, 2003. Centers for Disease Control and Prevention, MMWR. September 7, 2007. 56(35);912-915.
[29] Massachusetts Department of Public Health, Bureau of Community Health Access and Promotion. The Essential School Health Services Program Data Report, 2007-2008 School Year. 2009.
[30] Association of Occupational and Environmental Clinics. Accessed on January 26, 2009 at http://www.aoec.org/tools.htm
[31] Massachusetts Department of Public Health. Occupational Health Surveillance Program. Occupational Lung Disease Bulletin, July 2007. Accessed on January 26, 2009 at www.Mass.gov/dph/workrelatedasthma
[32] Massachusetts Department of Public Health, Occupational Health Surveillance Program. Occupational Lung Disease Bulletin, October 2008. Accessed on January 26, 2009 at www.Mass.gov/dph/workrelatedasthma
[33] Breton CV, Zhang Z, Hunt PR, Pechter E, Davis L. Characteristics of work related asthma: results from a population based survey. Occupational and Environmental Medicine; 63(6):411-415. June 2006.
[34] Homer CJ, Szilagyi P, Rodewald L, Bloom SR, et al. Does quality of care affect rates of hospitalization for childhood asthma? Pediatrics 98(1):18-23. 1996.
[35] Healthy People 2010. Accessed on January 26, 2009 at http://wonder.cdc.gov/data2010/
[36] Teleconference presentation with Jeanne Moorman. State-level Data: At-risk Based Rates. November 13, 2008.
[37] Healthy People 2010. Accessed on January 26, 2009 at www.healthypeople.gov
[38] Council of State and Territorial Epidemiologists, Environmental and Chronic Disease Committees. Asthma Surveillance and Case Definition – CSTE Position Statement 1998-ED/CD 1. Available at http://www.cste.org/dnn/AnnualConference/PositionStatements/tabid/191/Default.aspx
[39] Massachusetts Community Health Information Profile (MassCHIP) Win/32 Clinet. Version v3.0 r322. Database Version 20081208_1.
[40] Hunt P, Uk Won J, Dembe A, Davis L. Work-related hospitalizations in Massachusetts: racial/ethnic differences. Monthly Labor Review, October 2005.
[41] Personal communication, Bruce Cohen, Massachusetts Department of Public Health, June 2005.
[42] Massachusetts Department of Public Health, Health Survey Program. A profile of health among Massachusetts adults, 2007. December 2008.
[43] Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, [2000-2007].
[44] Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, [2000-2007].
[45] Centers for Disease Control and Prevention (CDC), National Center for Environmental Health. Behavioral Risk Factor Surveillance Systems Call-back Surveys. Available at http://www.cdc.gov/asthma/questions.htm#callback
[46] Jajosky RA, et al. Surveillance of work-related asthma in selected US states using surveillance guidelines for state health departments – California, Massachusetts, Michigan and New Jersey, 1993-1995. Centers for Disease Control and Prevention. MMWR. September 24; 48(37):833.
[47] Flattery J et al. The proportion of self-reported asthma associated with work in three states: California, Massachusetts, and Michigan, 2001. J Asthma 2006; 43:213-218.
[48] Klein RJ and Schoenborn CA. Age adjustment using the 2000 projected US population. Centers for Disease Control and Prevention and National Center for Health Statistics. January 2001. Number 20.